

d. The I/O Console is now ready for maintenance or repair. No warm-up period

CHAPTER 5

TROUBLESHOOTING

5-1. INTRODUCTION.

5-2. GENERAL INFORMATION. This chapter applies the planned maintenance philosophy in current usage aboard naval vessels and its applicability to the task of isolating malfunctions in the Input/Output Console OA-7984(V)/UYK (I/O Console). Refer to chapter 4 for more detailed information on scheduled maintenance and to chapter 6 for more detailed information on corrective maintenance and alignment procedures.

5-3. TROUBLESHOOTING. The material contained in this chapter is arranged to promote a logical process of elimination when troubleshooting. A troubleshooting index, protective device index, and general troubleshooting procedures are provided to aid in this endeavor. Figures 5-1 (FO) through 5-20 (FO) are functional schematics which should be referenced when isolating a malfunction.

5-4. Trouble Isolation and Testing. The primary troubleshooting tool for use on the I/O Console is the computer controlled maintenance test. The operating procedures for maintenance tests are listed in the Planned Maintenance System (PMS) Maintenance Requirement Cards (MRCs). For the proper operating procedures and the side by side listing of the maintenance program for the system installed refer to the appropriate PMS MRC. This test is designed to check the I/O Console devices in different operational modes and provide error detection and limited isolation. By running the various subtests, a failure can be isolated to a specific device (reader, punch, or keyboard/printer, or to the

control logic). If the failure is a device, chapter 6 provides procedures for either adjustment or replacement of the defective part. Logic failures are corrected by printed circuit module replacement. The sections of the maintenance test can be recycled to allow repetition of the failure to aid in tracing the signals through the functional schematics.

5-5. Troubleshooting Concept. The I/O Console troubleshooting concepts are based on the logical analysis of visual indications and test point checks, and the assumption that malfunctions can be isolated by the use of troubleshooting routines. Since printed circuit modules are considered nonrepairable items, the need of isolating a defective module component is eliminated. Following the detection of a malfunction, make a visual inspection of the panel indicators, switches, and fuses. If this inspection reveals a trouble area, a logical process of elimination will, in most instances, reveal the source of the trouble. A step-by-step power check can be used to supplement the visual inspection.

5-6. Troubleshooting Procedure. The troubleshooting information includes all recommended procedures for isolating I/O Console malfunctions as well as appropriate supporting maintenance data.

5-7. Test Points. The test terminal block (TB1) is located behind the I/O Console control panel (figure 5-21). Access to TB1 is gained by dropping the control panel down. This terminal block contains 231 test points, each identi-

fied by horizontal and vertical coordinates. The test points are wired to points in the logic circuitry, and are labeled on the functional schematics. For example refer to figure 5-4 which is the functional schematic for the keyboard and reader control. At coordinate 5A, locate inverter card type 2070 (7002070). Directly above this symbol is a test point labeled A20. This is the coordinate for this particular test point on TB1. The output of inverter 2070 can be checked by an oscilloscope at this test point. The voltages of the I/O Console power supply and the test points are listed in table 5-1.

5-8. Tape Reader. Tables 5-2 and 5-3, and figure 5-22 provide troubleshooting aids for the tape reader. Refer to figure 5-23 (F0) for the tape reader electrical schematic. Adjustment and replacement procedures are contained in chapter 6 and the appropriate PMS MRC.

5-9. Tape Punch. Refer to figures 3-106, 3-107, and 5-24 (F0) for troubleshooting the tape punch unit. Adjustment and replacement procedures are contained in chapter 6 and the appropriate PMS MRC.

5-10. Maintenance Turn-On Procedure. The I/O Console functions in two operating modes: on-line and off-line. The following operations are performed during both modes.

5-11. Console Turn-On Procedure. To energize the I/O Console, proceed as follows:

- a. Set POWER ON/OFF switch (figure 5-25) to ON position (ensure power is available at I/O Console).
- b. Determine that BLOWER POWER (DS1) and LOGIC POWER (DS2) indicator lights are energized, showing application of operating power to fan assemblies and logic chassis. If both indicators do not light, remove power from I/O Console and perform necessary maintenance before proceeding (figure 5-16).

c. Set ALARM BYPASS/NORMAL switch (S2) to NORMAL position to make over-temperature alarm operable.

d. The I/O Console is now ready for immediate operation. No warm-up period is required.

5-12. Refer to paragraphs 2-15 through 2-19 for procedure for loading tape punch, tape reader, and rewinding of tapes.

5-13. Console Turnoff Procedure. To remove power from the I/O Console, set the POWER ON/OFF switch on the power panel (figure 5-25) to the OFF position.

NOTE

Normally, the individual power switches on the tape punch, tapes reader, and keyboard/printer are not turned to OFF, since the application of power to these units is controlled by the logic circuitry of the I/O Console.

5-14. Relay, Switch, Lamp, and Protective Device Index. Tables 5-4, through 5-7, respectively, provide a reference index of relays, switches, indicator lamps, and protective devices installed in the I/O Console. These indexes may be used when troubleshooting as a ready reference to I/O Console and device malfunctions.

5-15. Combination Tool. A special combination tool (figure 5-26) is furnished with the computer for use in performing maintenance, service, and repair procedures.

5-16. FUNCTIONAL SCHEMATIC DIAGRAMS.

5-17. GENERAL. The functional schematic diagrams contain the necessary circuitry to illustrate the principles of operation and aid in troubleshooting the I/O Console. This circuitry includes logic circuits, power supply circuitry, power distribution diagrams, interface cabling, tape punch and tape reader schematic diagrams and a chassis map.

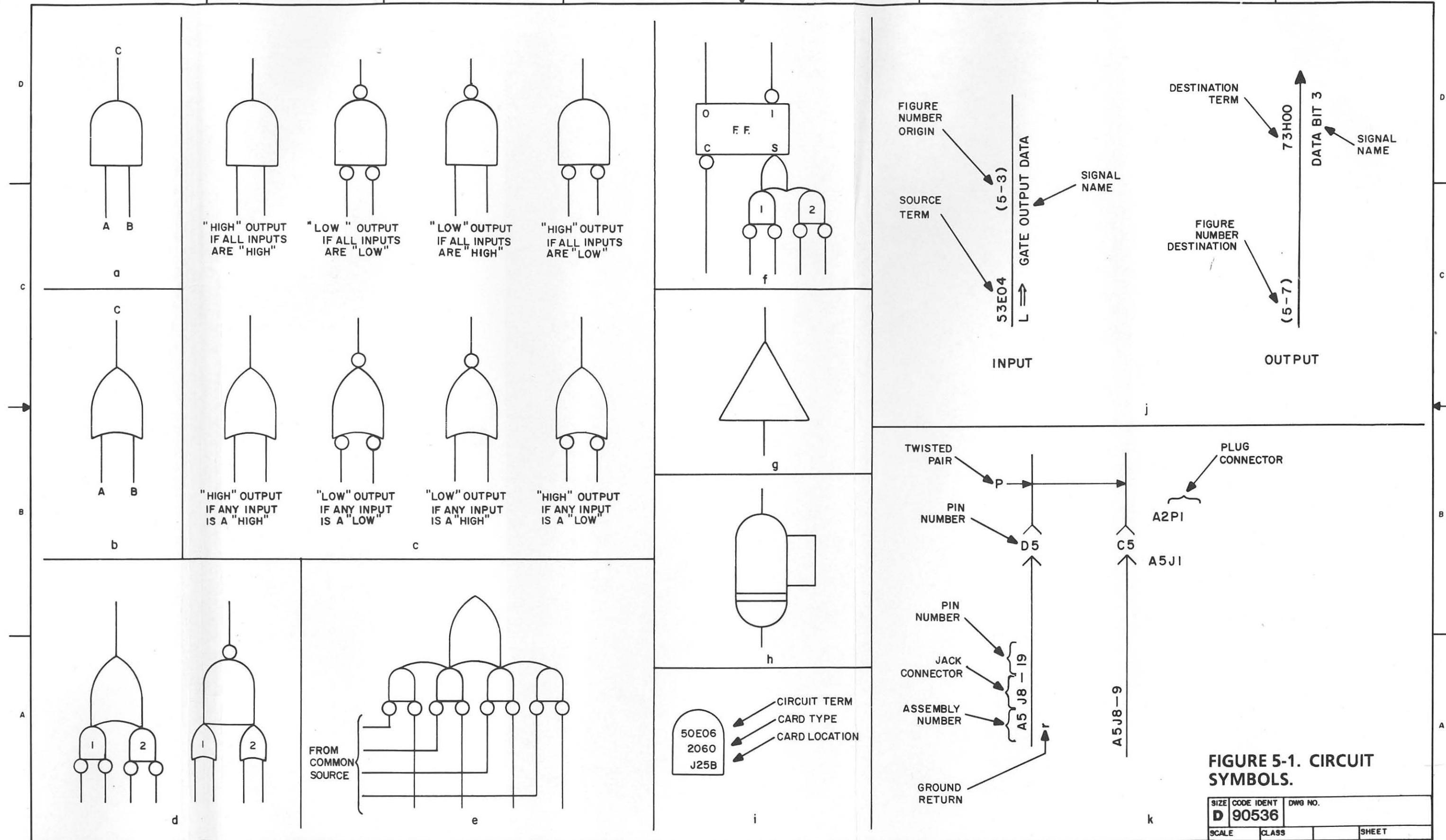


FIGURE 5-1. CIRCUIT SYMBOLS.

SIZE	CODE IDENT	DWG NO.
D	90536	
SCALE	CLASS	SHEET

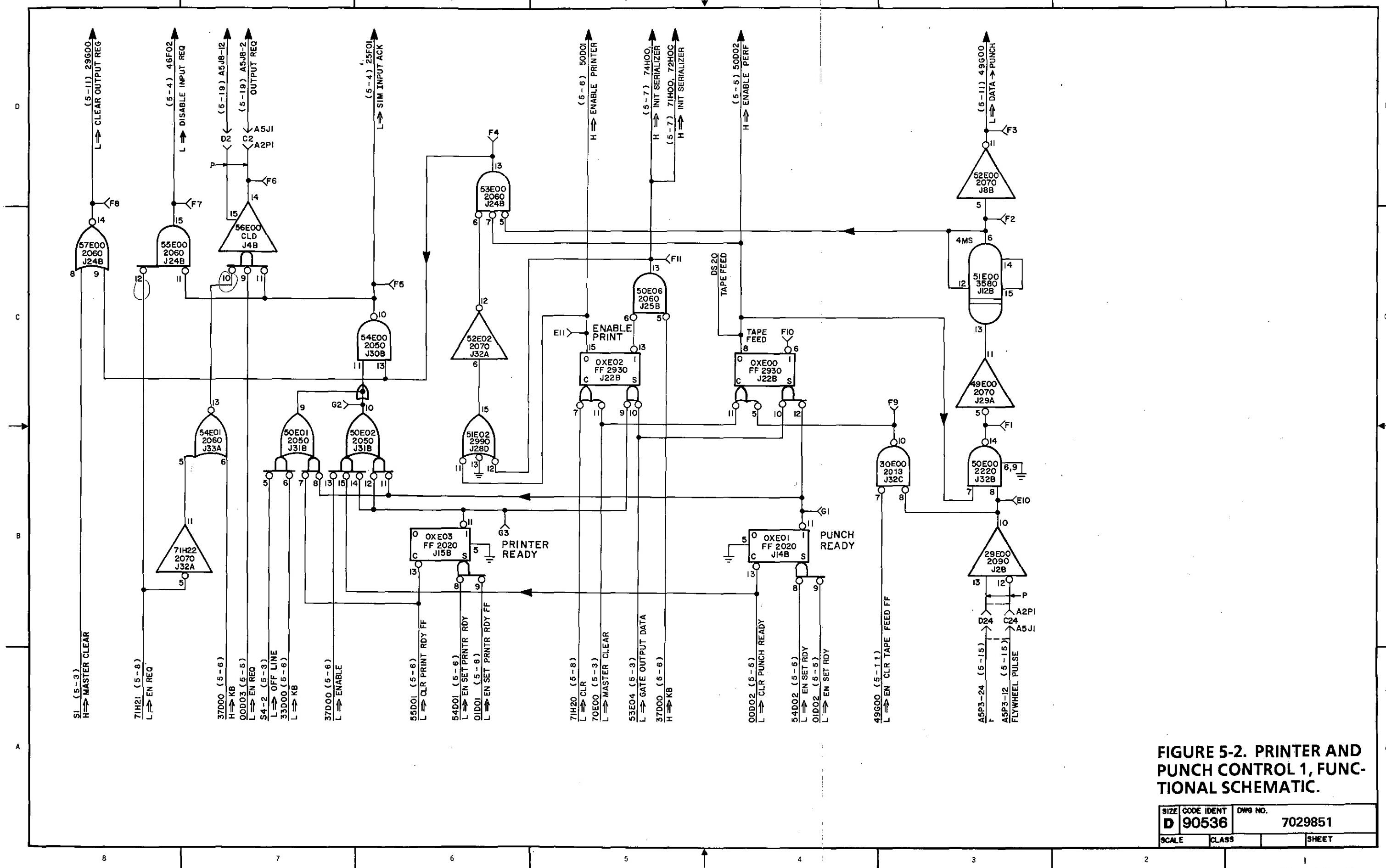
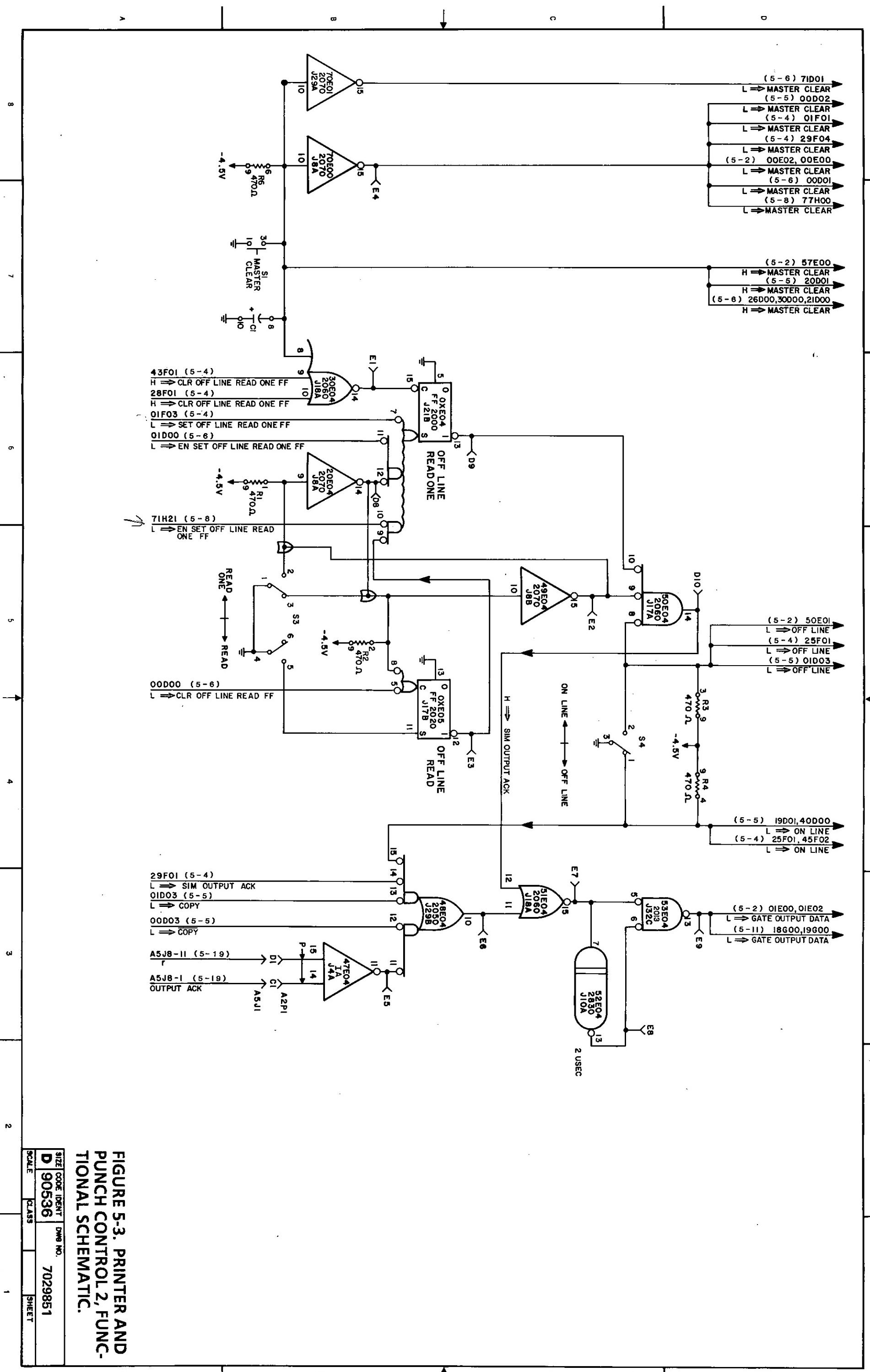


FIGURE 5-2. PRINTER AND PUNCH CONTROL 1, FUNCTIONAL SCHEMATIC.

SIZE	CODE	IDENT	DWG NO.
D	90536		7029851
SCALE	CLASS		

FIGURE 5-3. PRINTER AND PUNCH CONTROL 2, FUNCTIONAL SCHEMATIC.



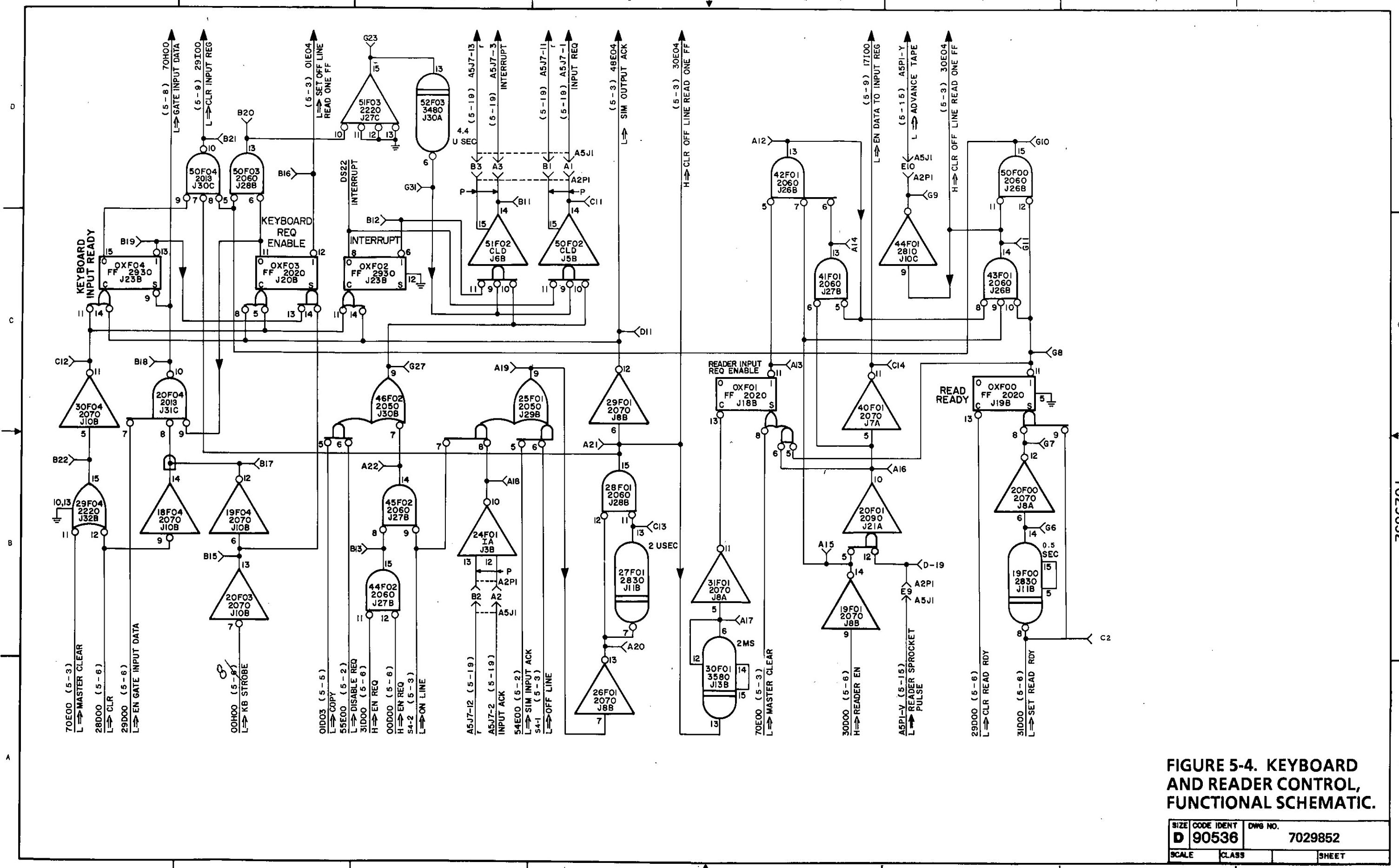
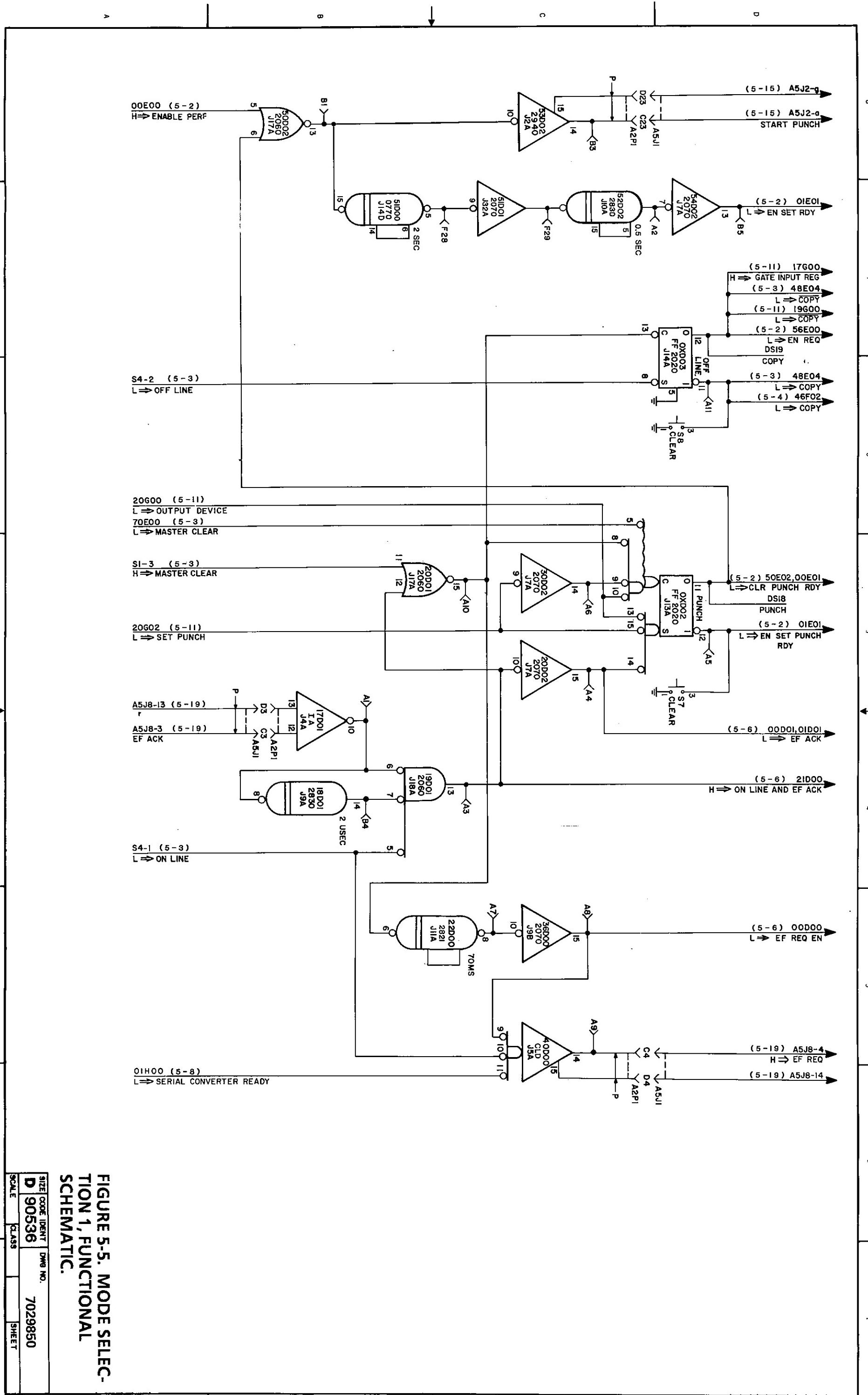


FIGURE 5-4. KEYBOARD
AND READER CONTROL,
FUNCTIONAL SCHEMATIC.

SIZE	CODE IDENT	DWG NO.
D	90536	7029852
SCALE	CLASS	SHEET

DO NOT SCALE THIS PRINT



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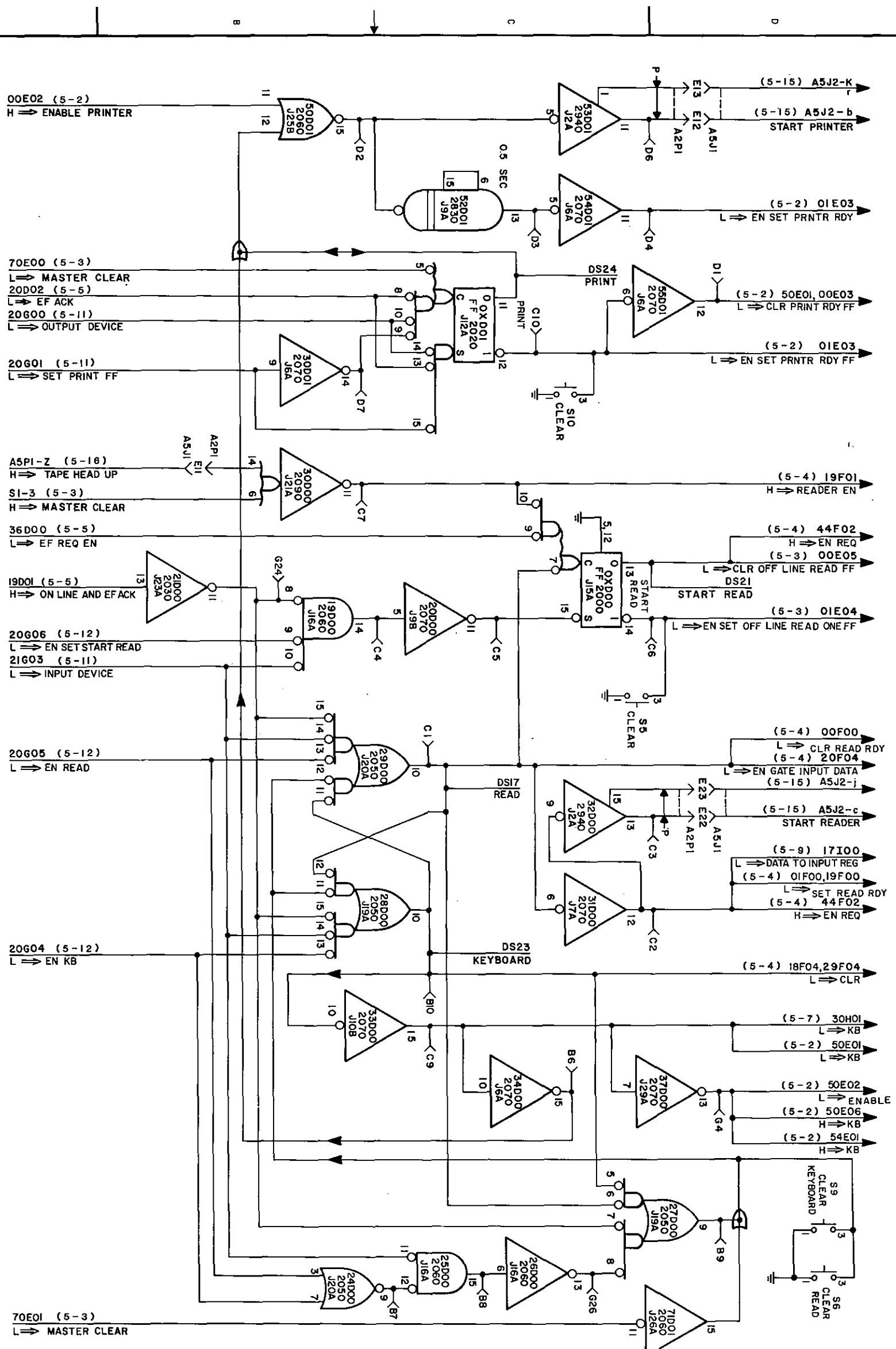


FIGURE 5-6. MODE SELECTION FUNCTION 2, FUNCTIONAL SCHEMATIC.

SIZE	CODE IDENT	DMG NO.
D	90536	7029850
SCALE	CLASS	SHEET

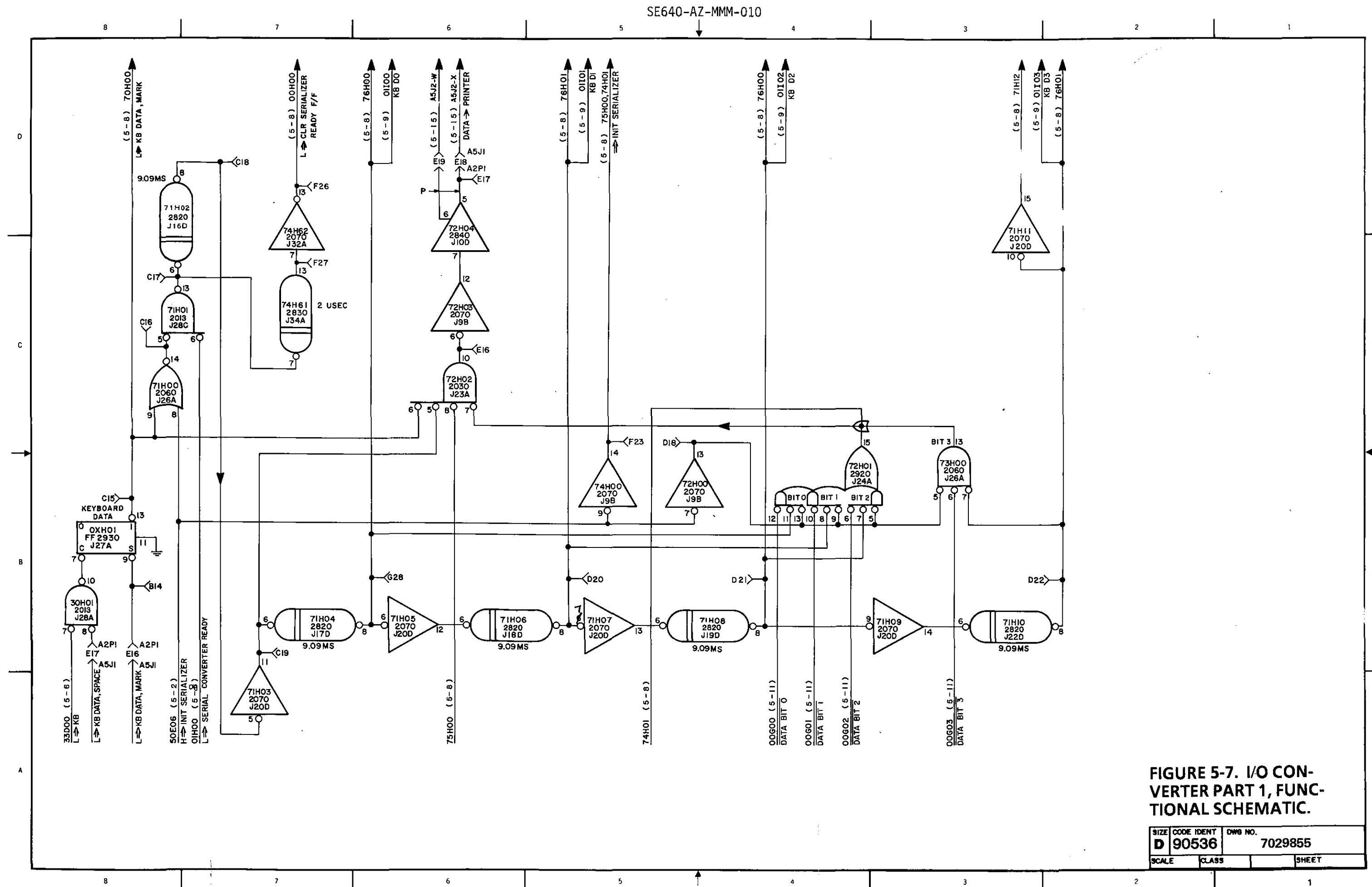


FIGURE 5-7. I/O CONVERTER PART 1, FUNCTIONAL SCHEMATIC.

SIZE D	CODE IDENT 90536	DWG NO. 7029855
SCALE	CLASS	SHEET

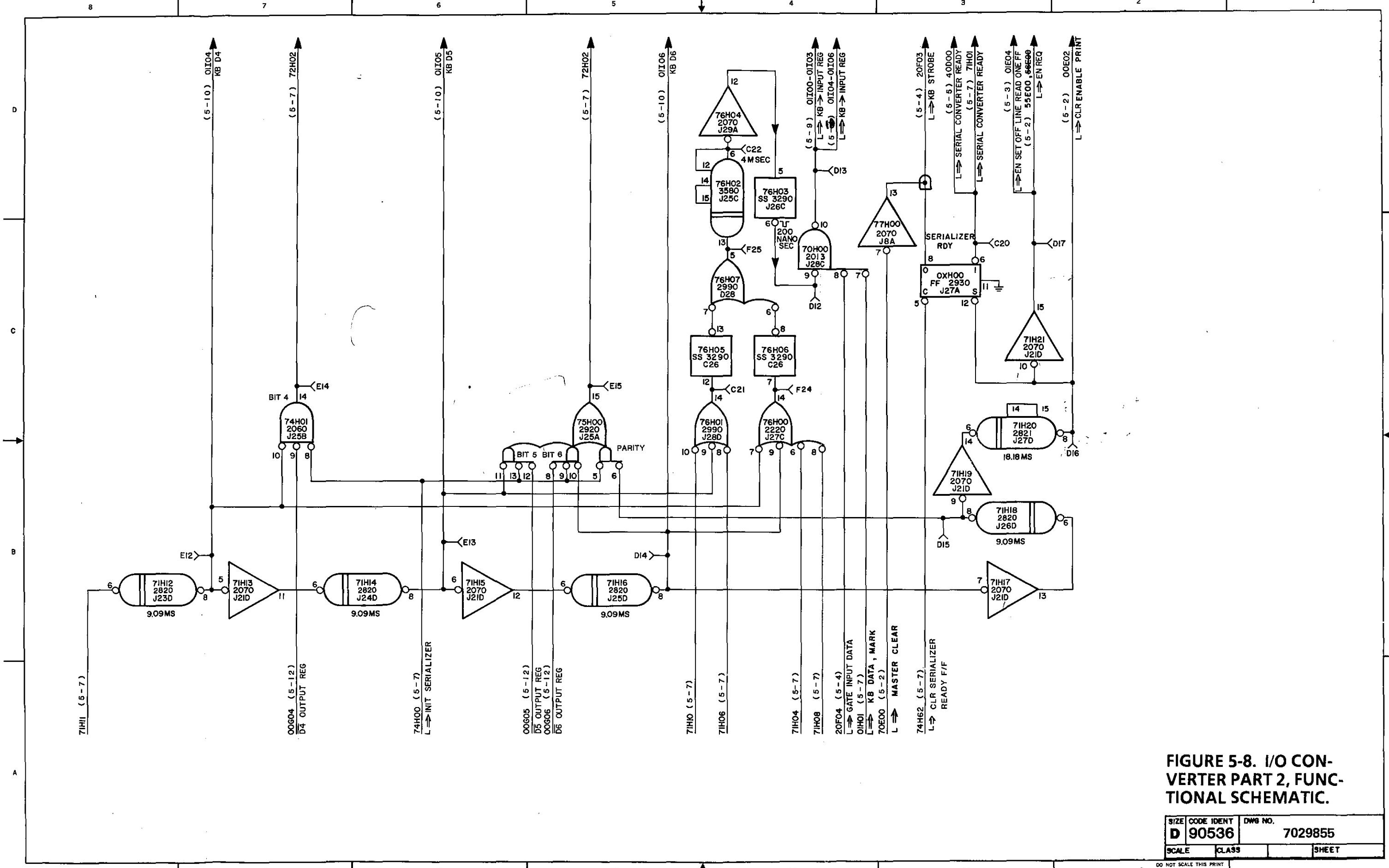
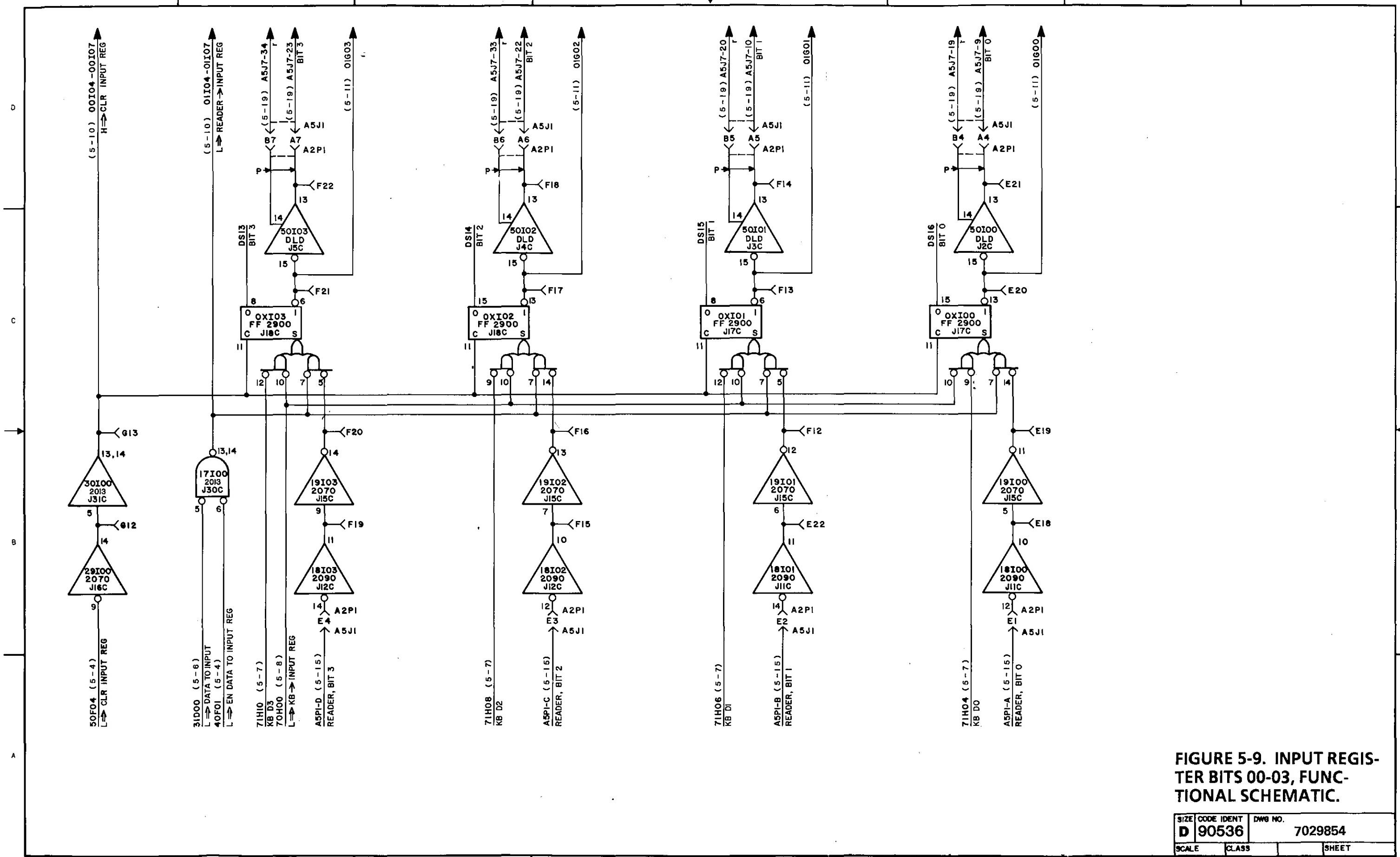


FIGURE 5-8. I/O CONVERTER PART 2, FUNCTIONAL SCHEMATIC.

SIZE D	CODE IDENT 90536	DWG NO. 7029855
SCALE	CLASS	SHEET



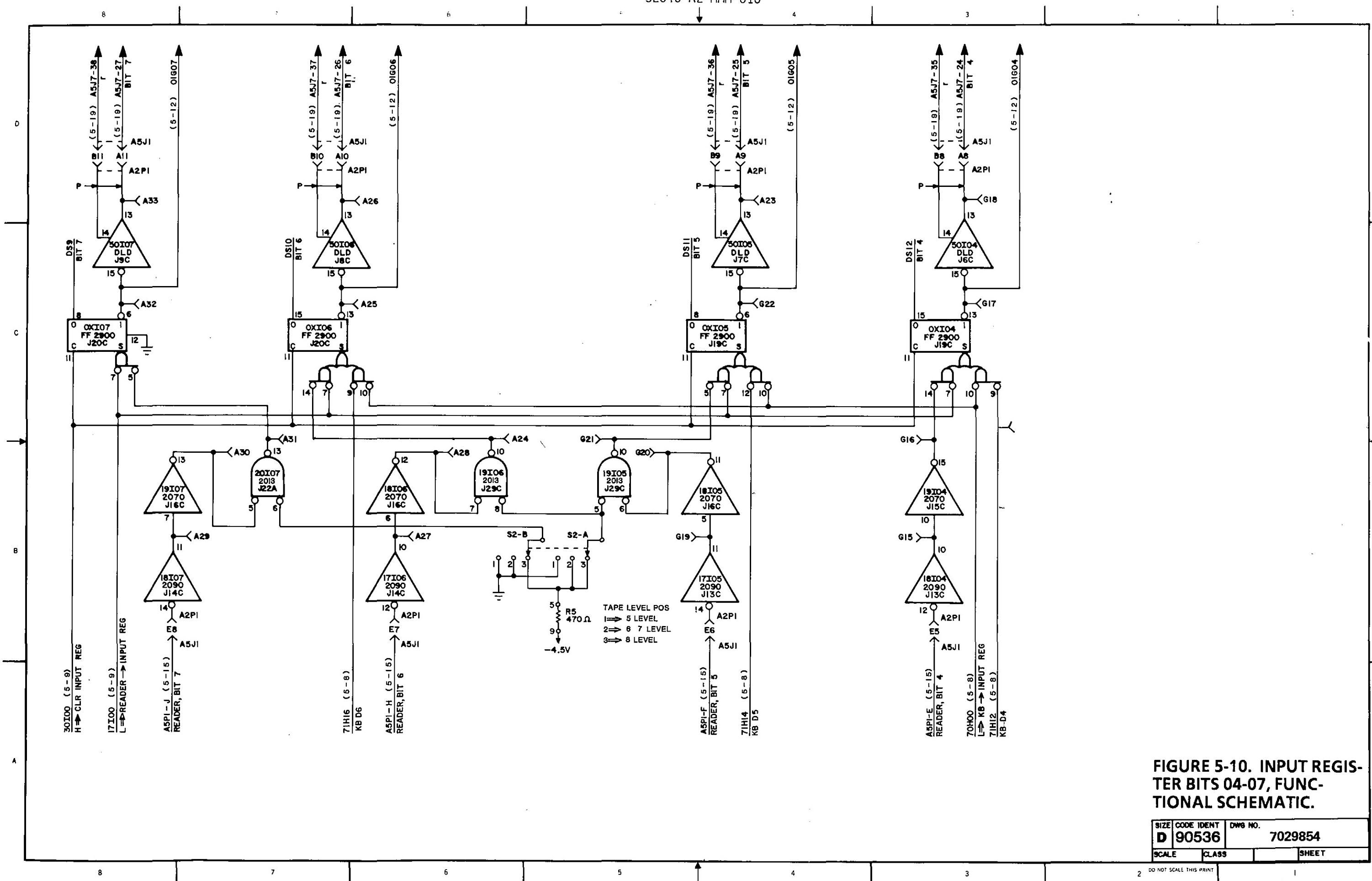


FIGURE 5-10. INPUT REGISTER BITS 04-07, FUNCTIONAL SCHEMATIC.

SIZE	CODE IDENT	DWG NO.
D	90536	7029854
SCALE	CLASS	SHEET

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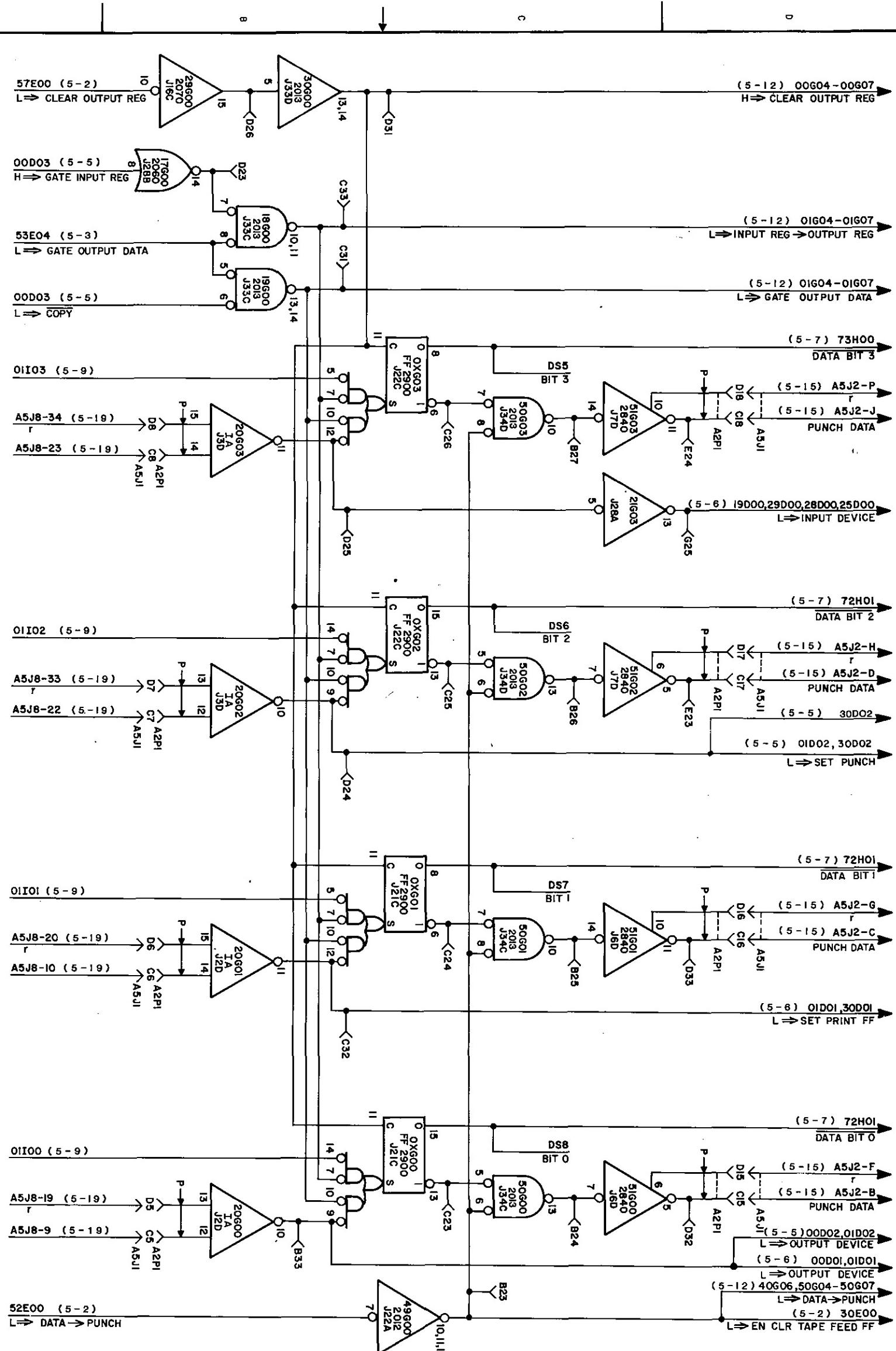
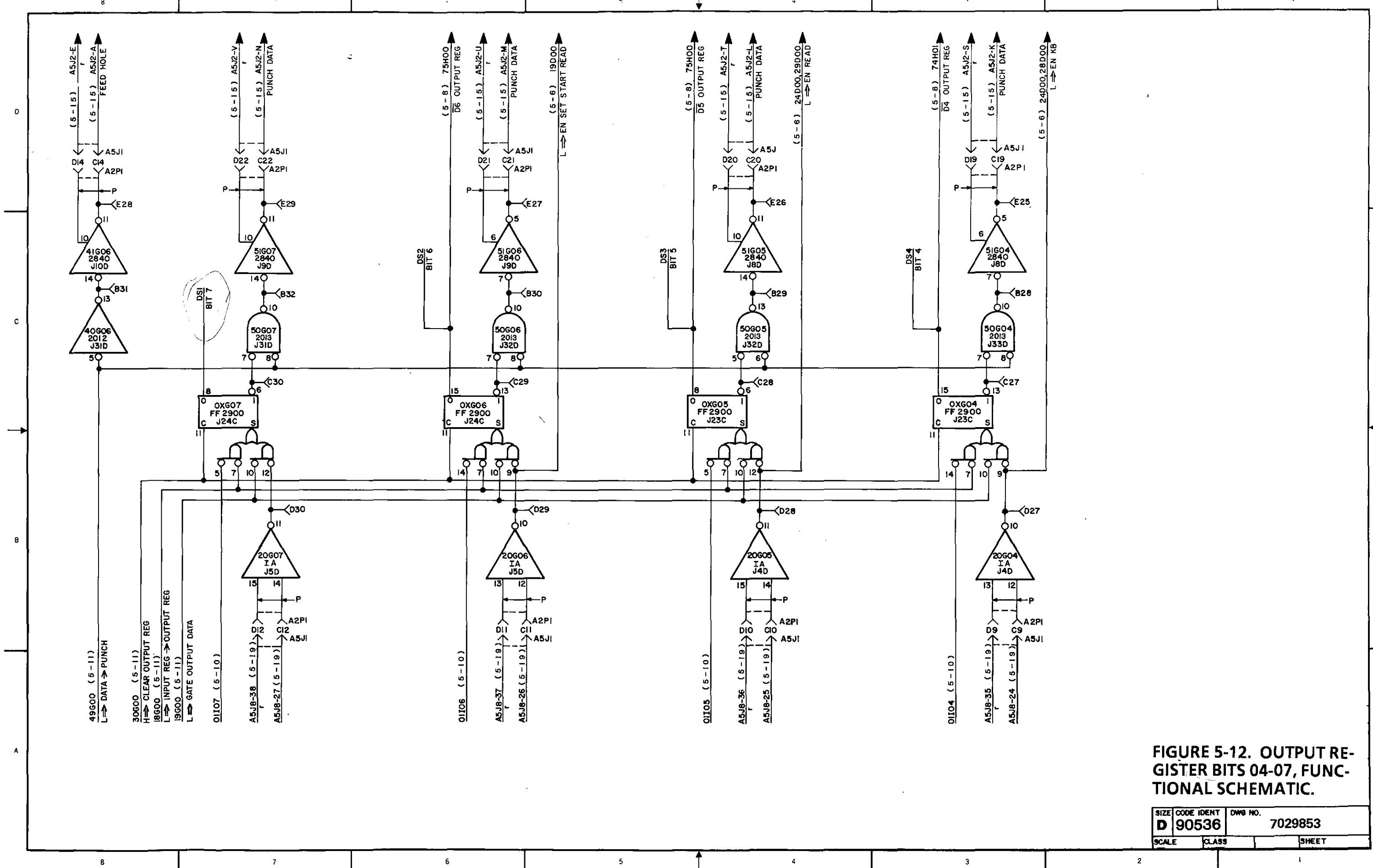


FIGURE 5-11. OUTPUT REGISTER BITS 00-03, FUNCTIONAL SCHEMATIC.

SIZE	CODE IDENT	DES. NO.
D	90536	7029853
SCALE	CLASS	SHEET



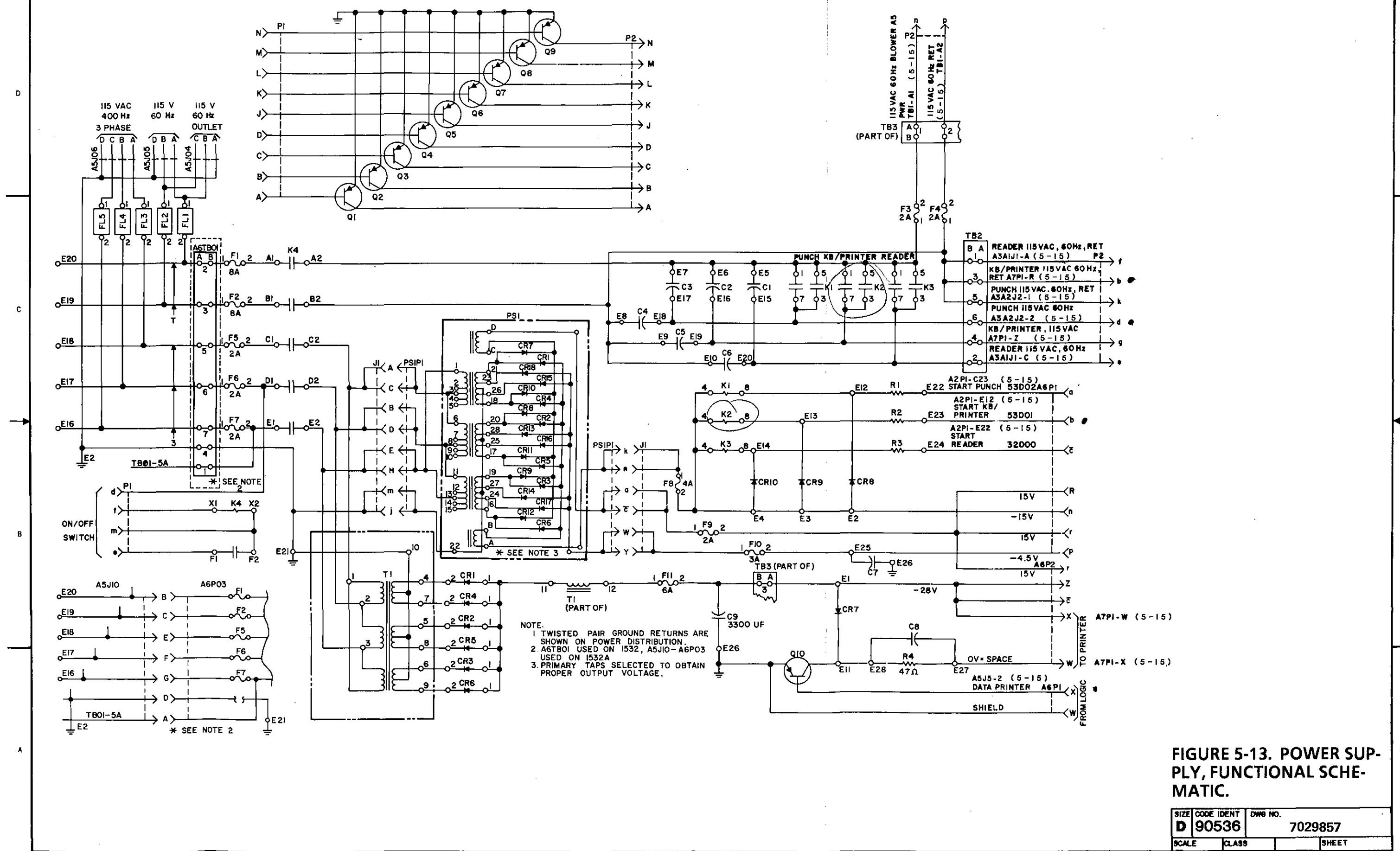


FIGURE 5-13. POWER SUPPLY, FUNCTIONAL SCHEMATIC.

SIZE	CODE IDENT	DWG NO.
D	90536	7029857
SCALE	CLASS	SHEET

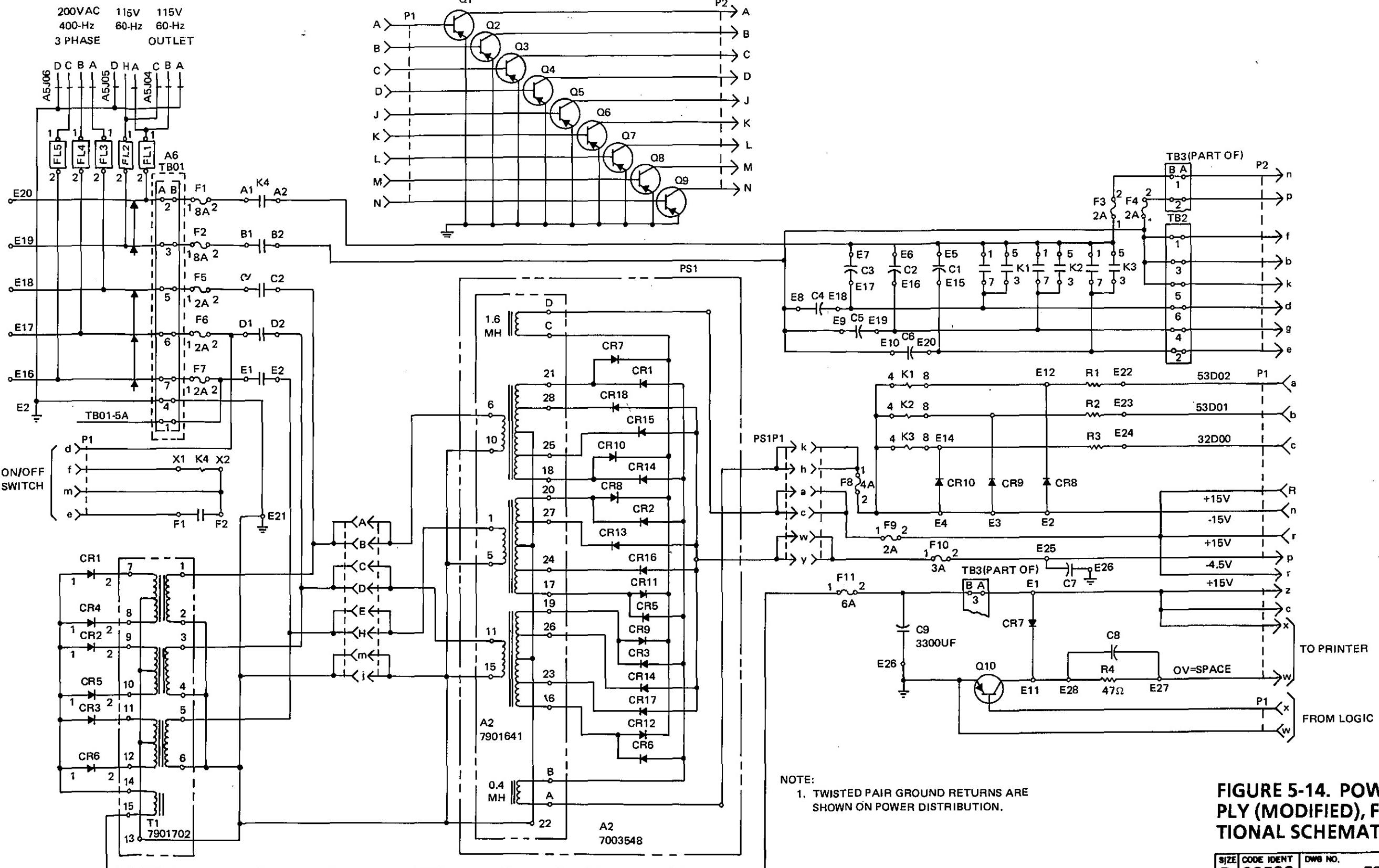
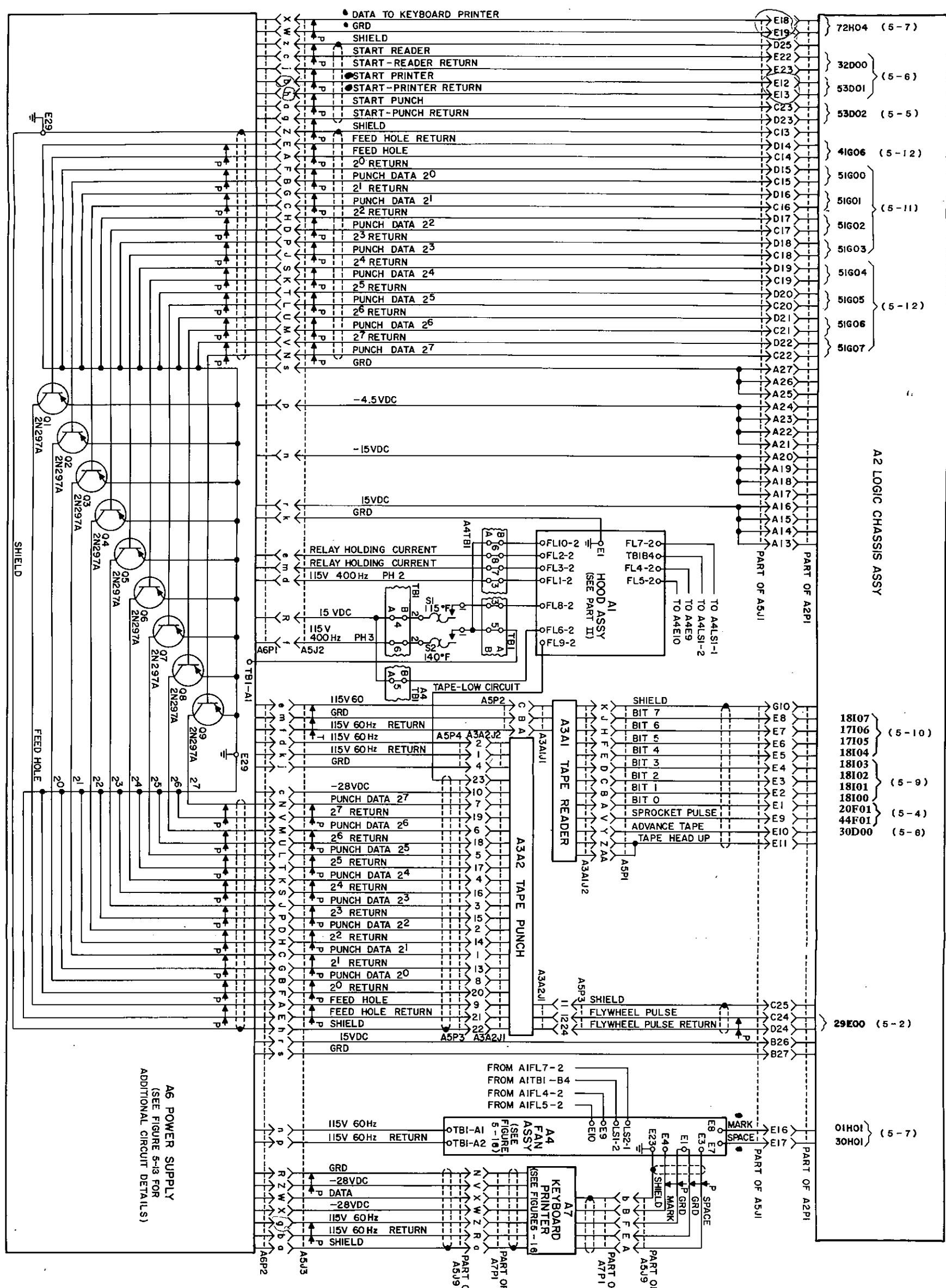


FIGURE 5-14. POWER SUPPLY (MODIFIED), FUNCTIONAL SCHEMATIC.

SIZE	CODE IDENT	DWG NO.
D	90536	7600331
SCALE	CLASS	SHEET



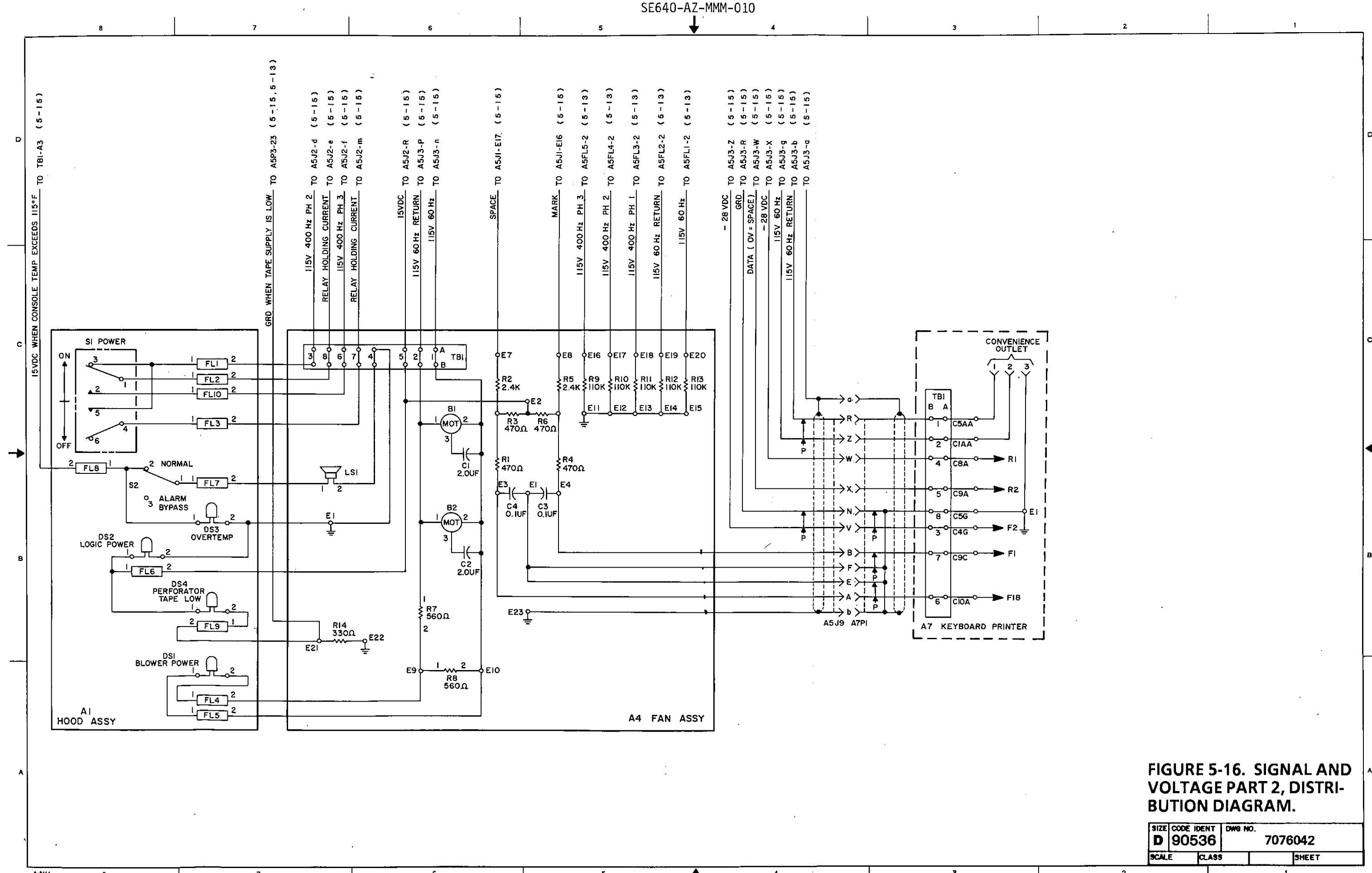


FIGURE 5-16. SIGNAL AND VOLTAGE PART 2, DISTRIBUTION DIAGRAM.

SIZE	CODE IDENT	DWG NO.
D	90536	7076042
SCALE	CLASS	SHEET

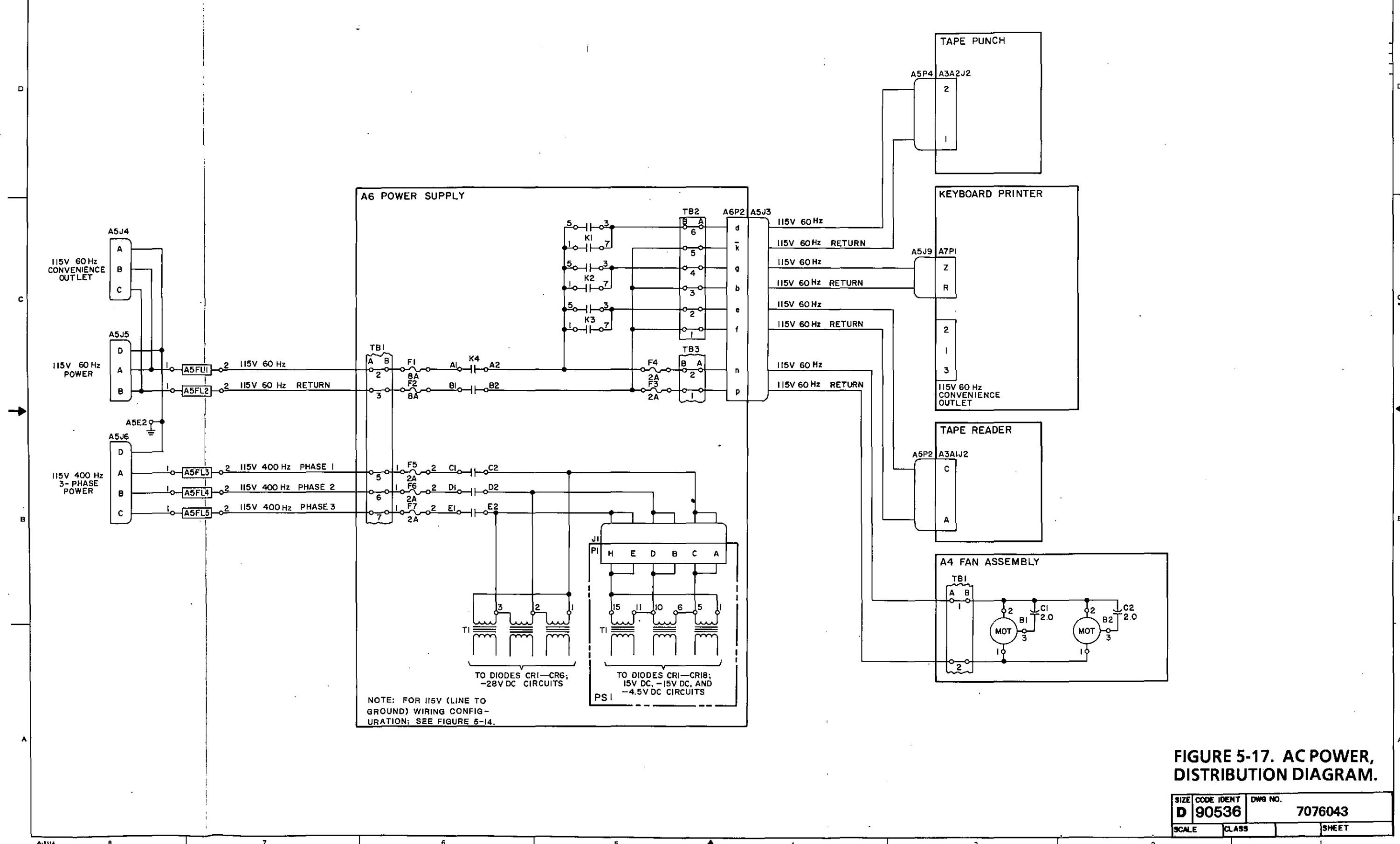
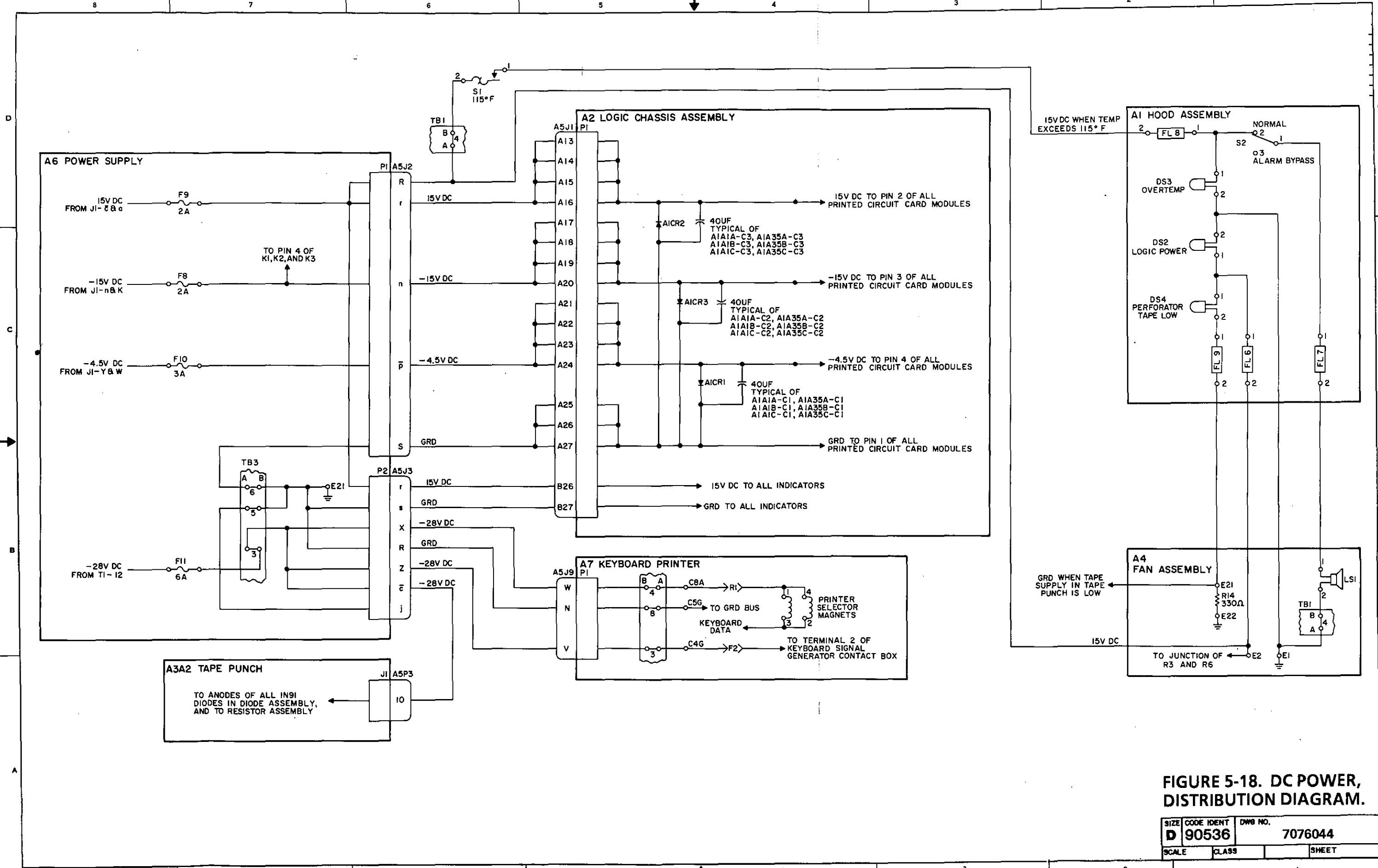


FIGURE 5-17. AC POWER, DISTRIBUTION DIAGRAM.

SIZE D	CODE IDENT 90536	DWG NO. 7076043
SCALE	CLASS	SHEET



**FIGURE 5-18. DC POWER,
DISTRIBUTION DIAGRAM.**

SIZE	CODE IDENT	Dwg No.
D	90536	7076044
SCALE	CLASS	SHEET

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DIGITAL DATA COMPUTER

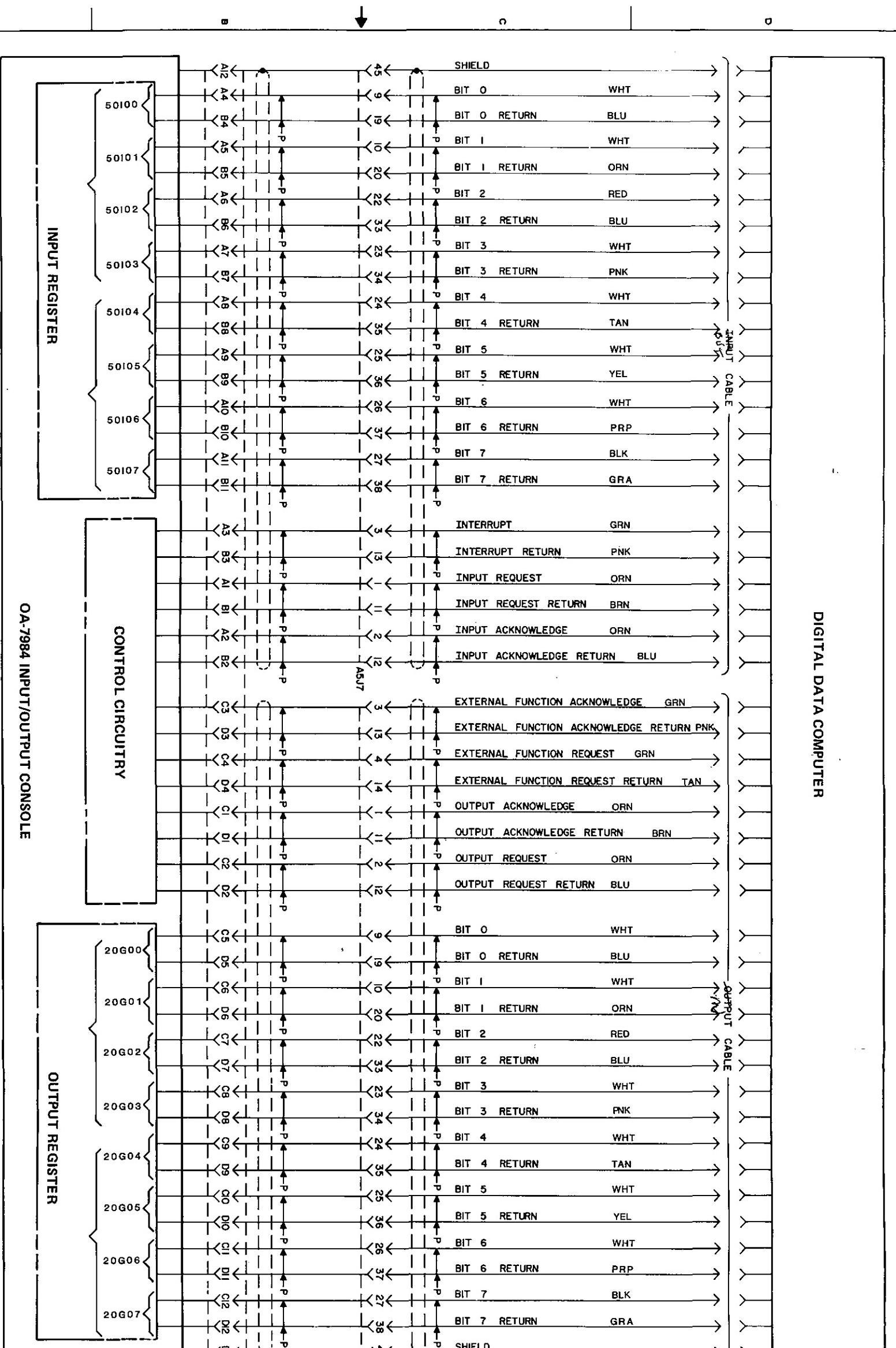


FIGURE 5-19. CONSOLE/
COMPUTER INTERFACE
CABLING, SCHEMATIC
DIAGRAM.

SIZE	CODE IDENT	DMB NO.
D	90536	7076045
SCALE	CLASS	SHEET

NOTE:

- * 2090 FOR SLOW INTERFACE
2322 FOR FAST INTERFACE
 - ** 2130 FOR SLOW INTERFACE
2332 FOR FAST INTERFACE
 - *** 2141 FOR SLOW INTERFACE
2342 FOR FAST INTERFACE

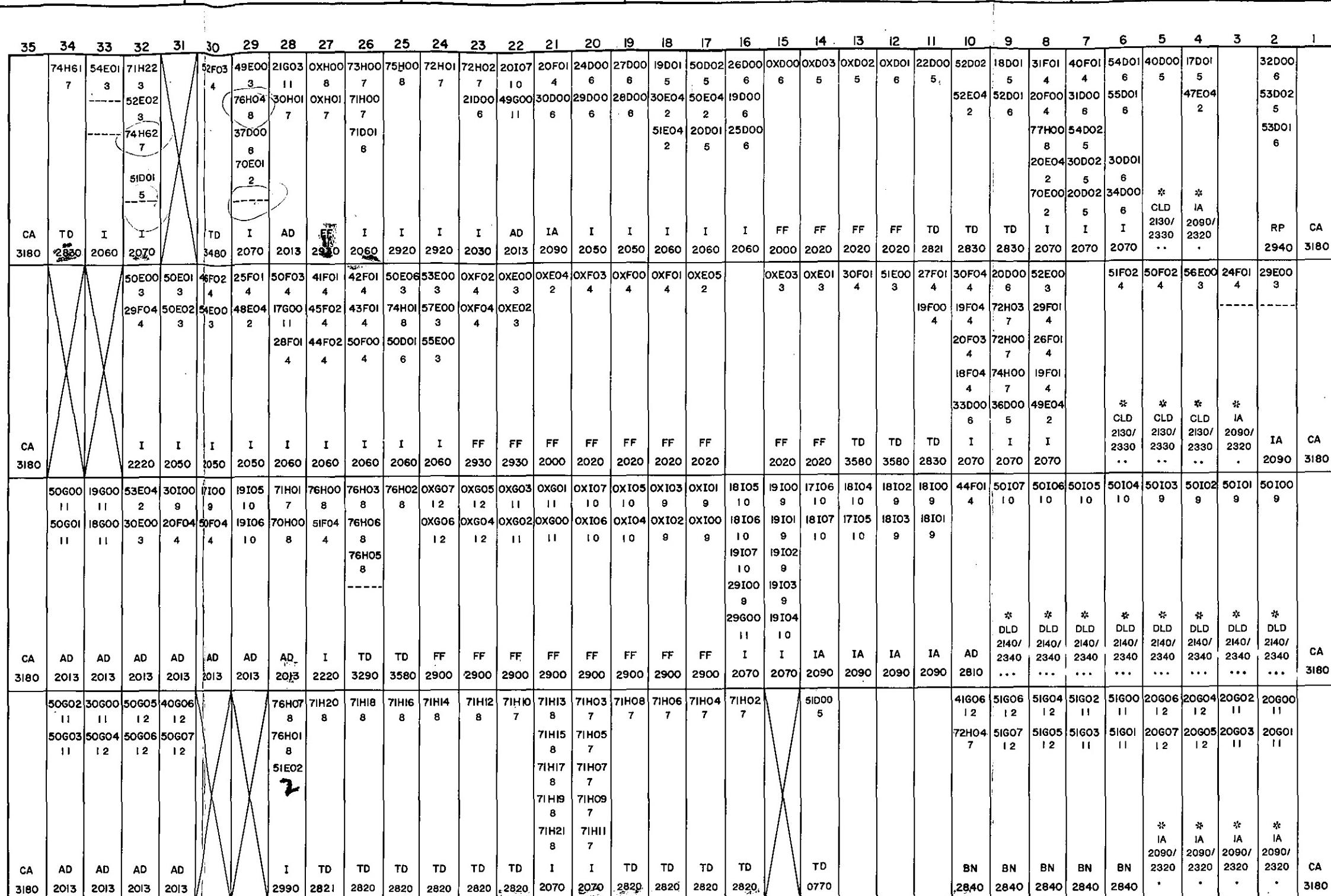


FIGURE 5-20. CHASSIS MAP.

SIZE	CODE IDENT	DWG NO.
D	90536	7029856
SCALE	CLASS	SHEET

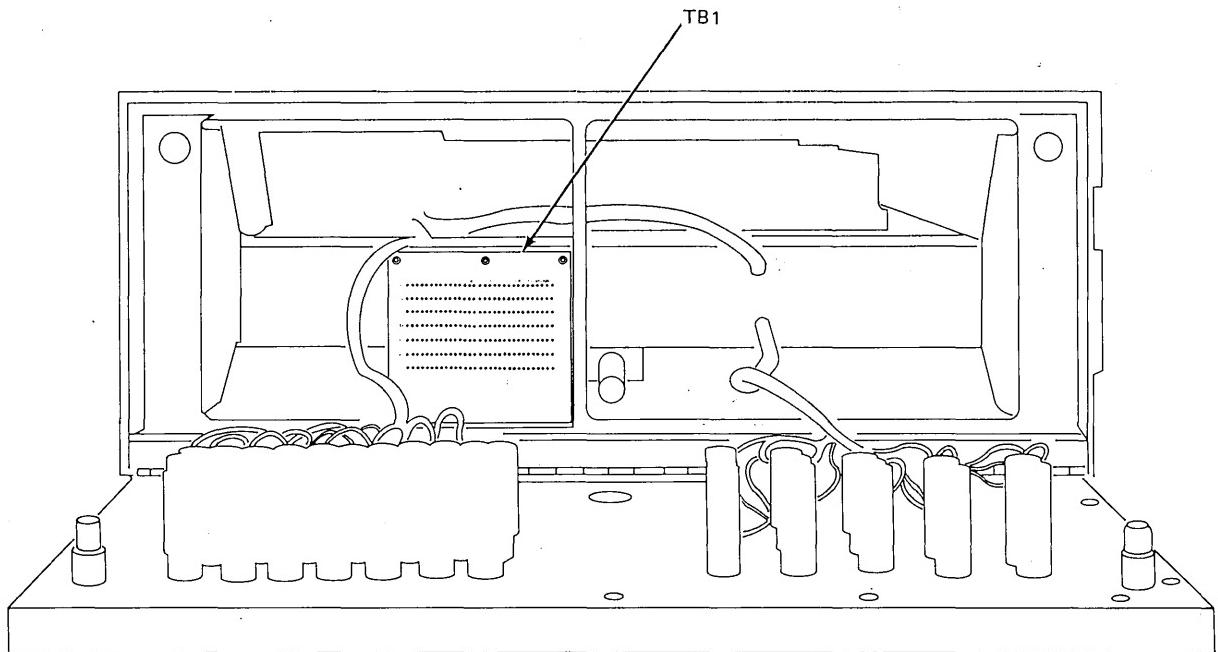


Figure 5-21. Test Block Location.

5-18. LOGIC SYMBOLOGY. Functional schematic diagrams are detailed block diagrams drawn in a manner that allows a logic symbol to represent a group of electronic components (printed circuit card) which perform a specific function.

5-19. Logic Design. The I/O Console is a binary device which requires that all inputs and outputs of logic functions be of high levels or low levels. The positive logic concept is used by zero volts representing a logic one (high) and -4.5 VDC representing a logic zero (low). This holds true for all signals except interface signals where polarities are reversed.

5-20. Logic Symbols. The symbols used for the circuitry in the functional schematics are explained and illustrated in chapter 3. A thorough understanding of the logic symbols is necessary to effectively troubleshoot the I/O Console.

5-21. DIAGRAMS. The diagrams contained in this chapter mainly consist of

functional and electrical schematic diagrams. These schematic diagrams are the most important tools available to technicians in troubleshooting the I/O Console, and also provide an excellent source of reference material.

5-22. Functional Schematic Diagrams. The functional schematic diagrams depict signal flow development from each stage influencing the signal presentation of the output. The schematic diagrams contain all the I/O Console logic circuits, test points, values, and references necessary to isolate malfunctions.

5-23. Electrical Schematic Diagrams. The electrical schematic diagrams supplement the functional schematic diagrams for detailed fault isolation. These schematic diagrams depict circuitry, signal and voltage distribution, power distribution, interface cabling, inputs and outputs, and provide function identification and values for all units of the I/O Console.

Table 5-1. I/O Console Power Supply Voltages

Power Supply	Voltage Range	Ripple (Maximum Peak to Peak)	Fuse Test Point
-15 VDC	-13.5 to -16.5 VDC	0.7 V	F8
-28 VDC	-27 to -33 VDC	0.7 V	F11
+15 VDC	+13.5 to +16.5 VDC	0.7 V	F9
-4.5 VDC	-4.0 to -5.2 VDC	0.7 V	F10

Table 5-2. Tape Reader Trouble Isolation Guide

Symptom	Probable Cause	Remedy
1. RUN signal applied but pinch roller does not energize	Defective control or pinch roller circuit Defective pinch roller coil	Check circuits and repair as required Replace coil
2. Pinch roller energizes tape does not run	Pinch roller-capstan gap too wide	Adjust pinch roller assembly
3. Tape rises off read head when pinch roller is energized	Pinch roller assembly out of adjustment	Adjust pinch roller assembly
4. Tape skews	Pinch roller assembly out of adjustment Brake assembly out of adjustment Adjustable tape guide in wrong tape width position Fixed or adjustable tape guide not adjusted properly	Adjust pinch roller assembly Adjust brake assembly Move tape guide to correct tape width Adjust tape guide
5. Tape runs too slow	Pinch roller-capstan gap too wide O-ring drive belt loose Defective drive motor	Adjust pinch roller-capstan gap Replace drive belt Replace drive motor
6. Capstan does not rotate	O-ring drive belt off pulley O-ring drive belt broken Defective motor	Replace drive belt on pulley Replace drive belt Replace motor

Table 5-2: Tape Reader Trouble Isolation Guide (Contd)

Symptom	Probable Cause	Remedy
7. Brake does not energize	Control or brake circuit defective	Check circuits and repair as required
	Brake coil defective	Replace brake coil
8. Nonexistent bit consistently being read	Defective photodiode	Check photodiode, and head assembly if required
	Data channel amplifier out of adjustment	Check and readjust as required
9. One bit consistently not being read	Defective data channel amplifier	Check amplifier and repair as required
	Defective photodiode	Check photodiode and replace head assembly if required
	Data channel amplifier out of adjustment	Check and readjust amplifier if required
	Defective data channel amplifier	Check amplifier and repair as required
10. One bit intermittently not being read, or nonexistent bit intermittently being read	Adjustable tape guide not in correct tape width position	Move guide to correct position
	Tape guide not adjusted properly	Adjust tape guide
	Tape improperly punched	Use new tape
	Incorrect exciter lamp voltage	Adjust R22 for proper voltage
	Photodiode dirty	Clean photodiodes
	DC voltages not properly regulated	Check DC supply and repair as required
	Intermittent photodiode	Check photodiode and replace head assembly if necessary
	Intermittent data channel amplifier	Check amplifier and repair as required
	Data channel amplifier out of adjustment	Check amplifier and readjust if required

Table 5-3. Tape Reader Resistance Measurements

From	To	Resistance (In Ohms)	Remarks
TB1-1	TB1-2	5.0	Primary of transformer (T1).
AC1	OV	0.4	Secondary of transformer (T1). Measurements made from edgeboard connections on MPC board. (See figure 6-59.)
AC2	OV	0.4	Secondary of transformer (T1). Measurements made from edgeboard connections on MPC board. (See figure 6-59.)
C1-1	C1-2	32.0	Filter winding of transformer (T1).
PR1C	PR2C	1.9	Pinch roller coil. Measurements made from edgeboard connections on MPC board. (See figure 6-59.)
B1C	B2C	1.3	Brake coil. Measurements made from edgeboard connections on MPC board. (See figure 6-59.)

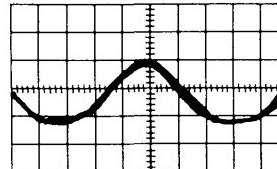
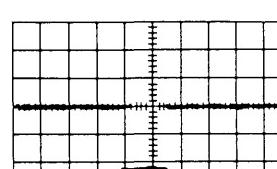
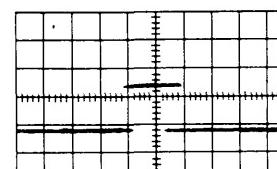
Waveform (Refer to figure 5-23)	Oscilloscope Settings			Trigger	Oscilloscope Presentation
	Vert (v/cm)	Horiz (ms/cm)	Trigger Mode		
W1	5.0	0.5	Ext (+)	CH-1 Photodiode Output	
W2	5.0	0.5	Ext. (+)	CH-1 Photodiode Output	
W3	5.0	0.5	Ext (+)	CH-1 Photodiode Output	

Figure 5-22. Tape Reader Circuit Waveforms (Sheet 1 of 3).

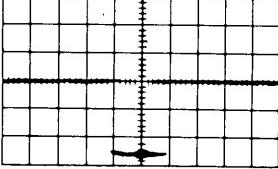
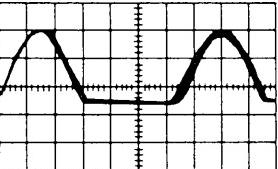
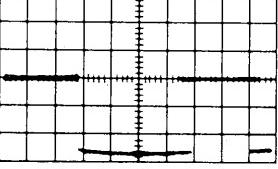
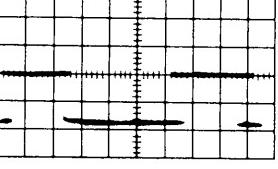
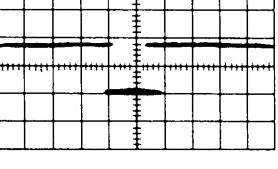
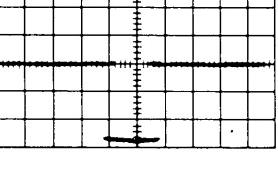
Waveform (Refer to figure 5-23)	Oscilloscope Settings			Trigger	Oscilloscope Presentation
	Vert (v/cm)	Horiz (ms/cm)	Trigger Mode		
W4 (No Load)	5.0	0.5	Ext (+)	CH-1 Photodiode Output	
W5	5.0	0.5	Ext (+)	CH-1 Photodiode Output	
W6 (Ungated, No Load)	5.0	0.5	Ext (+)	CH-1 Photodiode Output	
W7 (Ungated, 2K ohm Load)	5.0	0.5	Ext (+)	CH-1 Photodiode Output	
W8	5.0	0.5	Ext (+)	CH-1 Photodiode Output	
W9 (Gated, No Load)	5.0	0.5	Ext (+)	CH-1 Photodiode Output	

Figure 5-22. Tape Reader Circuit Waveforms (Sheet 2 of 3).

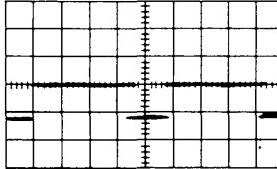
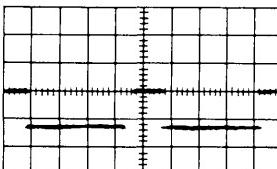
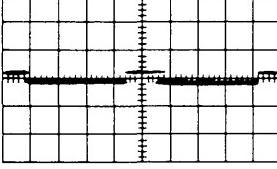
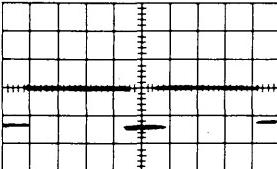
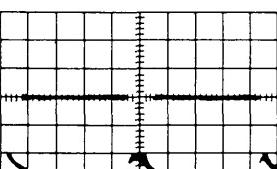
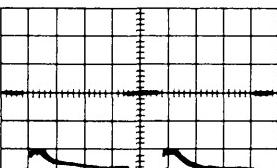
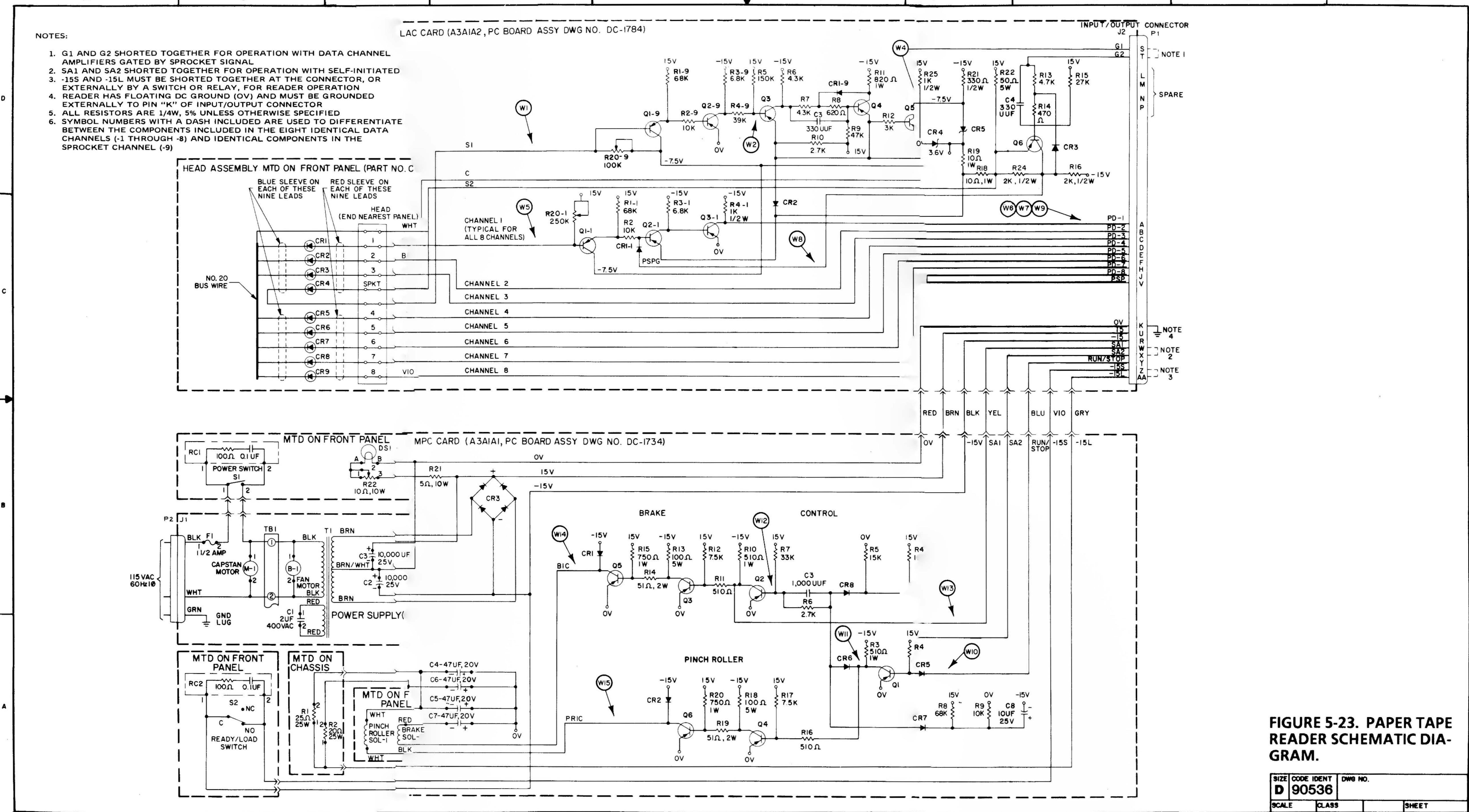
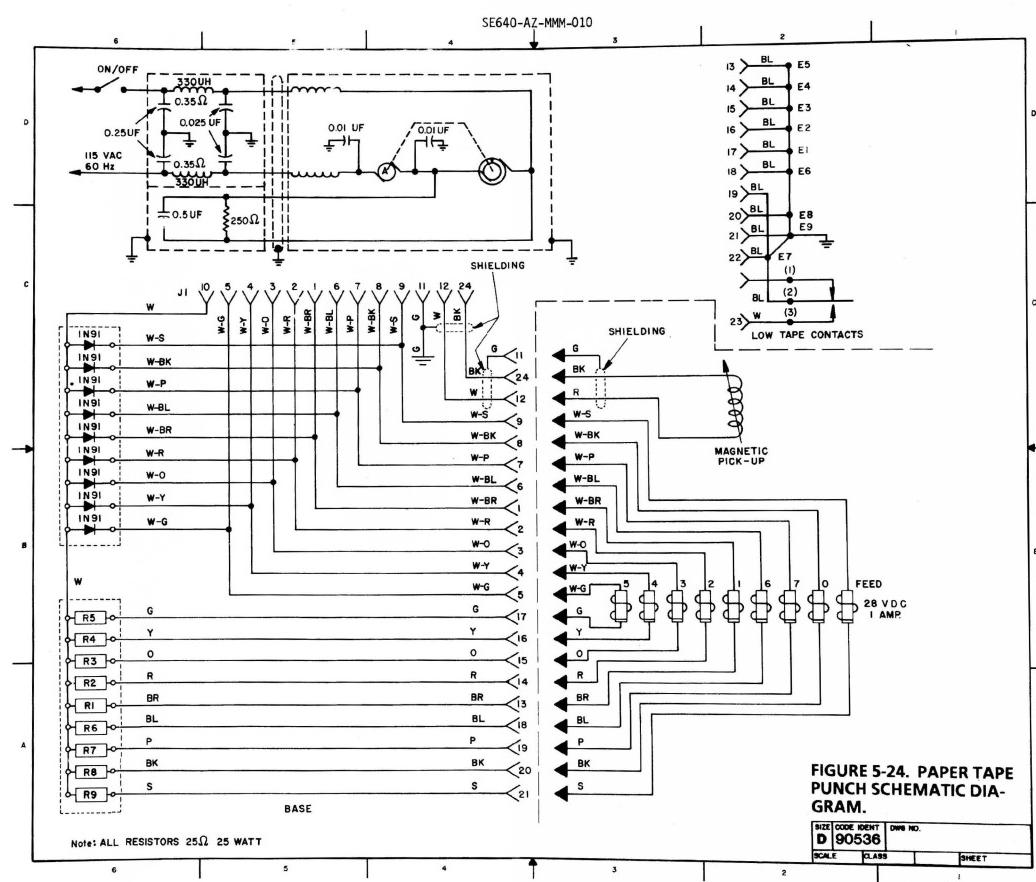
Waveform (Refer to figure 5-23)	Oscilloscope Settings			Trigger	Oscilloscope Presentation
	Vert (v/cm)	Horiz (ms/cm)	Trigger Mode		
W10	5.0	5.0	Ext (-)	RUN Signal	
W11	5.0	5.0	Ext (-)	RUN Signal	
W12	5.0	5.0	Ext (-)	RUN Signal	
W13	5.0	5.0	Ext (-)	RUN Signal	
W14	5.0	5.0	Ext (-)	RUN Signal	
W15	5.0	5.0	Ext (-)	RUN Signal	

Figure 5-22. Tape Reader Circuit Waveforms (Sheet 3 of 3).





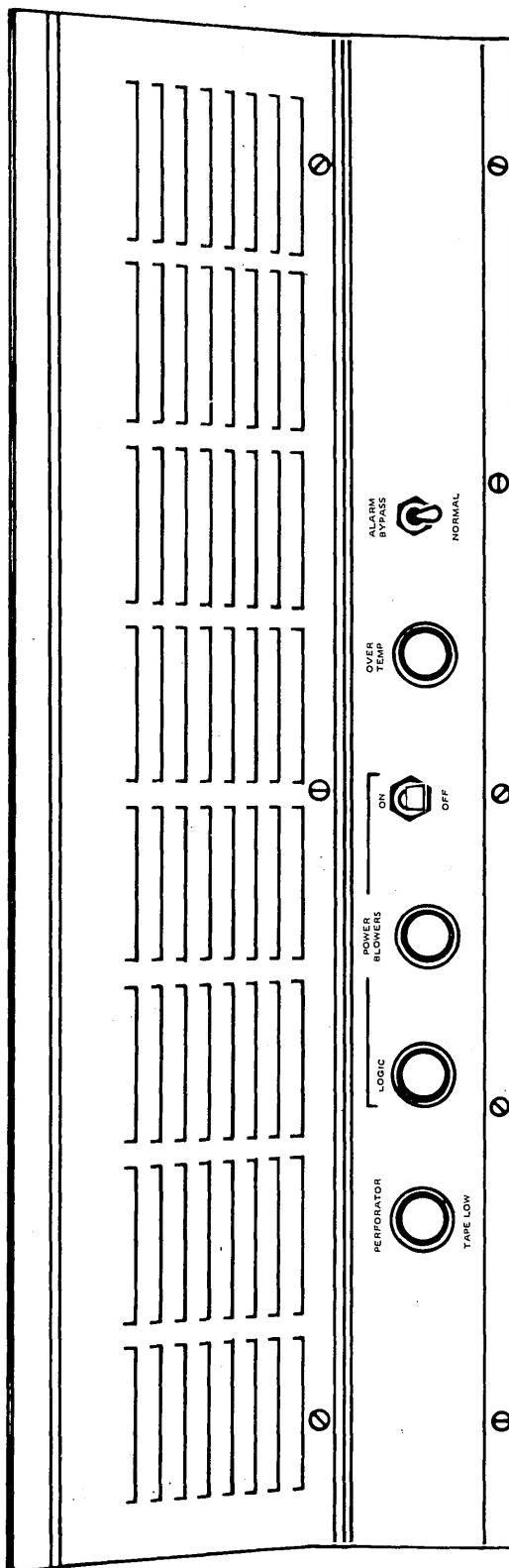


Figure 5-25. I/O Console Power Panel.

Table 5-4. Relay Index

Relay No.	Function	Coil Voltage	Figure	Unit
K1	Applies 115-VAC 60-Hz to tape punch circuits	-15 VDC	5-13, 5-17	A6
K2	Applies 115-VAC 60-Hz to keyboard/printer circuits	-15 VDC	5-13, 5-17	A6
K3	Applies 115-VAC 60-Hz to tape	-15 VDC	5-13	A6
K4	Applies 115-VAC 60-Hz to tape reader, and contacts of K1, K2, and K3; applies 115-VAC 400-Hz 3 phase to power supply circuits	115-VAC 400-Hz 3 phase	5-13, 5-17	A6

Table 5-5. Switch Index

Switch No.	Function	Switched Voltage	Figure	Unit
	CONSOLE			
S1	Overtemperature protection thermal switch (actuates alarm when cabinet temperature exceeds 115°F)	15-VDC	5-14	Console
S2	Overtemperature protection thermal switch (removes all power when cabinet temperature exceeds 140°F)	115-VAC 400-Hz 3 phase	5-14	Console
	HOOD ASSEMBLY			
S1	Power ON-OFF switch	115-VAC 400-Hz 3 phase	5-15	A1
S2	NORMAL/ALARM BYPASS switch	15-VDC	5-15	A1
	CONTROL/INDICATOR			
S1	MASTER CLEAR	-4.5 VDC	5-3	A2A2
S2	Tape Levels	-4.5 VDC	5-11	A2A2
S3	Read-Read ONE	-4.5 VDC	5-3	A2A2

Table 5-5. Switch Index (Contd)

Switch No.	Function	Switched Voltage	Figure	Unit
	CONTROL/INDICATOR (Contd)			
S4	OFF Line - ON Line	-4.5 VDC	5-3	A2A2
S5	Clear (Start-Read)	Applies Ground	5-6	A2A2
S6	Clear (Read)	Applies Ground	5-6	A2A2
S7	Clear (Punch)	Applies Ground	5-5	A2A2
S8	Clear (Copy)	Applies Ground	5-5	A2A2
S9	Clear (Keyboard)	Applies Ground	5-6	A2A2
S10	Clear (Print)	Applies Ground	5-6	A2A2
XDS1 thru XDS24	Momentary pushbutton type switches included with indicator DS1 thru DS24. Refer to table 5-6, Lamp for Control Indicator lamp designations.	---	---	A2A2
	KEYBOARD/PRINTER			
S1	ON-OFF Switch	115-VAC 60-Hz	---	A7
A	MARGINAL INDICATOR switch	115-VAC	---	A7
	TAPE READER			
S1	ON-OFF power switch	115-VAC 60-Hz	5-23	A3
S2	READY/LOAD switch	115-VAC 60-Hz	5-23	A3
	TAPE PUNCH			
S1	ON-OFF Power Switch	115-VAC	5-24	A3

Table 5-6. Lamp Index

Lamp No.	Lamp Name	Energizing Voltage	Figure	Unit
	HOOD ASSEMBLY			
DS1	Blower Power	115-VAC 60-Hz	5-15	A1
DS2	Logic Power	15-VDC	5-15	A1
DS3	Overtemp	15-VDC	5-15	A1
DS4	Perforator Tape Low	15-VDC	5-15	A1
	CONTROL/INDICATOR			
DS1	BIT 7 OUTPUT	15-VDC	5-12	A2A2
DS2	BIT 6 OUTPUT	15-VDC	5-12	A2A2
DS3	BIT 5 OUTPUT	15-VDC	5-12	A2A2
DS4	BIT 4 OUTPUT	15-VDC	5-12	A2A2
DS5	BIT 3 OUTPUT	15-VDC	5-11	A2A2
DS6	BIT 2 OUTPUT	15-VDC	5-11	A2A2
DS7	BIT 1 OUTPUT	15-VDC	5-11	A2A2
DS8	BIT 0 OUTPUT	15-VDC	5-11	A2A2
DS9	BIT 7 INPUT	15-VDC	5-10	A2A2
DS10	BIT 6 INPUT	15-VDC	5-10	A2A2
DS11	BIT 5 INPUT	15-VDC	5-10	A2A2
DS12	BIT 4 INPUT	15-VDC	5-10	A2A2

Table 5-6. Lamp Index (Contd)

Lamp No.	Lamp Name	Energizing Voltage	Figure	Unit
	CONTROL/INDICATOR (Contd)			
DS13	BIT 3 INPUT	15-VDC	5-9	A2A2
DS14	BIT 2 INPUT	15-VDC	5-9	A2A2
DS15	BIT 1 INPUT	15-VDC	5-9	A2A2
DS16	BIT 0 INPUT	15-VDC	5-9	A2A2
DS17	READ	15-VDC	5-6	A2A2
DS18	PUNCH	15-VDC	5-5	A2A2
DS19	COPY	15-VDC	5-5	A2A2
DS20	TAPE FEED	15-VDC	5-2	A2A2
DS21	START FEED	15-VDC	5-2	A2A2
DS22	INT (INTERRUPT)	15-VDC	5-4	A2A2
DS23	KEYBOARD	15-VDC	5-6	A2A2
DS24	PRINT	15-VDC	5-6	A2A2
---	COPY LIGHT	6.3-VAC	---	A7
---	END OF LINE	6.3-VAC	---	A7
DS1	EXCITER LAMP	8.6-VDC	5-23	A3

Table 5-7. Protective Device Index

Designation	Size	Area Protected	Remarks
F1	8A	115-VAC 60-Hz	---
F2	8A	115-VAC 60-Hz	---
F3	2A	115-VAC 60-Hz	Blowers
F4	2A	115-VAC 60-Hz	Blowers
F5	2A	115-VAC ¹ 400-Hz phase 1	---
F6	2A	115-VAC ¹ 400-Hz phase 2	---
F7	2A	115-VAC ¹ 400-Hz phase 3	---
F8	4A	-15 VDC	Pin 3 of all printed circuit modules
F9	2A	-15 VDC	Console indicators, pin 2 of all printed circuit modules
F10	3A	-4.5 VDC	Pin 4 of all printed circuit modules
F11	6A	-28 VDC	Paper tape punch, keyboard/printer logic
S1	115°F	-15 VDC	I/O Console overtemp
S2	140°F	115-VAC, 400-Hz phase 3	I/O Console overtemp
F1	1.5A	115-VAC 60-Hz	Paper tape reader motor and power supply
		Thermostatic cutout switch ²	Paper tape punch motor overload protection
		Thermostatic cutout switch ³	Keyboard/printer motor overload protection

NOTE:

¹208-VAC when measured line to line.²Located on base next to paper tape punch motor. May be reset when motor has cooled.³Located on base next to keyboard/printer motor. May be reset when motor has cooled.

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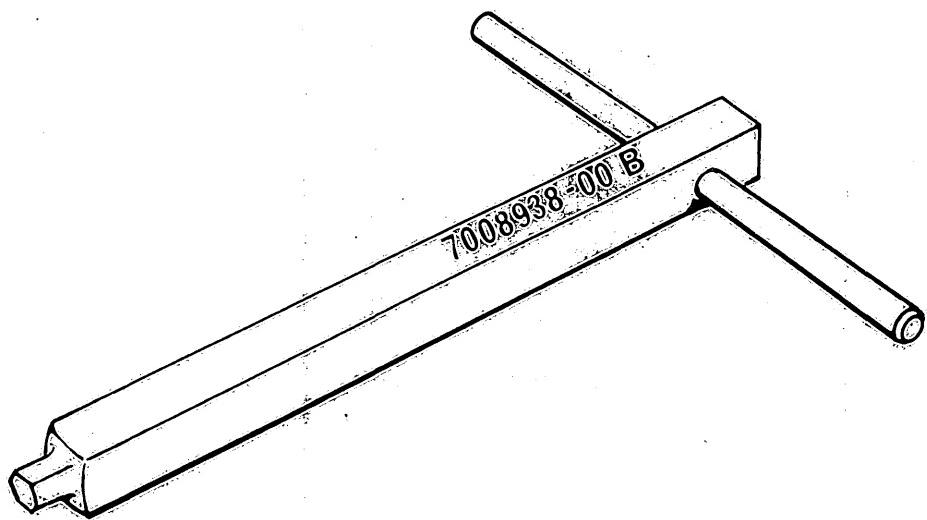


Figure 5-26. Combination Tool.